OES NOT CIRCULATE

UNIVERSITY OF MICHIGAN
JUN 18 1954
MEDICAL LIBRARY

# The Journal of the International College of Surgeons

FOUNDED BY DR. MAX THOREK

Vol. XXI *May, 1954* No. 5

# PLAN TO ATTEND

THE NINETEENTH

CONGRESS AND CONVOCATION

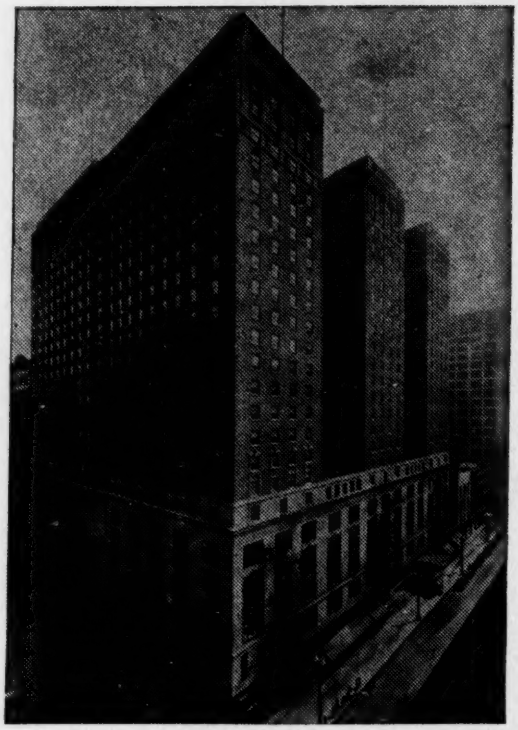
of the

UNITED STATES AND CANADIAN SECTIONS

of the

INTERNATIONAL COLLEGE OF SURGEONS

at



PALMER HOUSE—CHICAGO

*Congress Headquarters*

September 7 to 10 inc., 1954

*For information regarding preliminary program and reservations, etc., address:*

Dr. Karl A. Meyer, F.A.C.S., F.I.C.S., Secretary
1516 Lake Shore Drive
Chicago 10, Illinois

# The Journal of the International College of Surgeons

FOUNDED IN GENEVA, SWITZERLAND, 1935 - INCORPORATED IN WASHINGTON, D. C., 1940

**Editor-in-Chief**
MAX THOREK, M.D., Sc.D., LL.D., F.B.C.S., F.I.C.S., F.P.C.S. (Hon.), F.R.S.M.

**Associate Editor**
PHILIP THOREK, M.D., F.A.C.S., F.I.C.S.

**Consulting Editor**
MORRIS FISHBEIN, M.D., F.I.C.S. (Hon.)

**News Editor**
DR. JOSE MARIA CABELLO CAMPOS, São Paulo, Brazil

**Assistant Editors**
Dorothy Langley and Dora Stone

**Production Assistant**
Frances Cretcher

**Publication Committee**

Francisco Graña, M.D., *Chairman*
Rudolph Nissen, M.D.
Henry W. Meyerding, M.D.
Max Thorek, M.D., *Editor-in-Chief*
Arnold S. Jackson, M.D.
Edward L. Compere, M.D.

**Summary Editors**

Dr. Manuel A. Manzanilla, Jr., Mexico
*Spanish*
Dr. F. Luz Filho, Salvador, Bahia, Brazil
*Portuguese*
Dr. Fritz Rothbart, Chicago
*German*
Dr. Albert Jentzer, Geneva
*French*
Dr. Antonello Franchini and
Dr. Marino Mini, Bologna
*Italian*

CONTENTS—MAY, 1954

Tumors of the Parotid Gland ..... 545
*George J. Papayannopoulos, M.D.†, Athens, Greece; Kenneth C. Sawyer, M.D., F.A.C.S., F.I.C.S.; and Alexis E. Lubchenco, M.D., Denver, Colorado*

Retropubic Prostatectomy ..... 559
*Francis A. Beneventi, M.D., F.A.C.S., F.I.C.S., New York City, New York*

Hamartoma of the Hand ..... 574
*Timothy A. Lamphier, M.D., F.A.C.S., A.I.C.S., Boston, Massachusetts*

†Deceased

Hamartoma of the Lung ..... 578
*Emanuel Marcus, M.D., Ph.D., F.A.C.S., F.I.C.S., Chicago, Illinois*

Release of Adduction Contracture of the Thumb ..... 584
*Michael Burman, M.D., New York City, New York*

Cineplasties and the Newer Technics ..... 593
*Ernst W. Bergmann, M.D., D.A.B., F.I.C.S., New York City, New York*

Congenital Skin Defects: Report of Three Cases ..... 599
*James Buford Johnson, M.D., F.I.C.S., Beverly Hills, California*

Preliminary Report on a New Concept in the Operative Management of Lesions of the Supraspinatus Tendon ..... 607
*Frederick Sypher, M.D., F.R.C.S., F.I.C.S., Toronto, Ontario, Canada*

Massive Arterial Thrombosis ..... 617
*Paul S. Lowenstein, M.D., F.A.C.S., F.I.C.S., St. Louis, Missouri*

Rhinoplastic Surgical Problems ..... 621
*Louis J. Feit, M.D., F.A.C.S., F.I.C.S., New York City, New York*

Effect of Intravenous Procaine on Anuria and Oliguria Associated with the Toxemias of Pregnancy ..... 630
*Milton J. Serwer, A.B., M.D., F.I.C.S., Oklahoma City, Oklahoma*

Torsion of the Omentum ..... 641
*Lawrence S. Mann, M.S., M.D., F.A.C.S., F.I.C.S., Chicago, Illinois*

Systemic Manifestations of Anorectal Disease ..... 644
*George H. Thiele, M.D., F.A.C.S., F.I.C.S., Kansas City, Missouri*

Section on Ophthalmology and Otorhinolaryngology ..... 650
Surgical Treatment of Perilenticular Membranes in Children
*Otis R. Wolfe, M.D., F.I.C.S.*

EDITORIAL
Custis Lee Hall Memorial Lecture 1953: Surgical Complications of Diverticulosis ..... 666
*Charles S. White, M.D., F.A.C.S., F.I.C.S., Washington, D. C.*

NEW BOOKS ..... 671

ABSTRACTS FROM CURRENT LITERATURE ..... 675

FOUNDED BY DR. MAX THOREK

# The Journal of the International College of Surgeons

FOUNDED IN GENEVA, SWITZERLAND, 1935 - INCORPORATED IN WASHINGTON, D. C., 1940

Vol. XXI MAY, 1954 No. 5

## *Original Articles*

# Tumors of the Parotid Gland

GEORGE J. PAPAYANNOPOULOS, M.D.†

ATHENS, GREECE

KENNETH C. SAWYER, M.D., F.A.C.S., F.I.C.S. AND

ALEXIS E. LUBCHENCO, M.D.

DENVER, COLORADO

TUMORS of the parotid gland, since 1863, have been a matter of great interest, research, controversy, and obscurity among pathologists and surgeons.

Seventeen cases have been previously reported from Presbyterian Hospital. Thirty-nine cases from Presbyterian Hospital, together with 3 cases from three other hospitals, covering a period of a little more than seven years, constituted excellent material for study in the series reported in this paper. The histogenetic and pathologic picture of the parotid tumor, as well as other features, have been examined. There are strong reasons to believe that these tumors are of parotid epithelial and not of anlage origin. The adenolymphomas are definitely neoplasms, although in a considerable percentage of cases there is a history of infection. Under the microscope we have observed combined forms of tumors, including elements of different neoplasmatic entities.

In the light of the preceding statements, we have considered the treatment.

*Historical Notes.* — Virchow[1] was the first to describe mixed tumors of the parotid gland and name them enchondromas. He also described them as mixed tumors.

†Deceased; former Exchange Fellow in Surgery, Colorado School of Medicine.

Read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.

Submitted for publication Nov. 18, 1953.

Innumerable histogenetic theories and names followed. Ehrich,[2] in 1906, expressed the opinion that the tumors are of salivary epithelial origin. This viewpoint is generally accepted today, although several eminent pathologists, such as McFarland,[3] consider the elements as being enclaved embryonic cells. Chevassu[4] and later Ewing[5] expressed the opinion that no single theory of histogenesis was sufficient to explain the origin of these tumors and that more than one theory was valid in explaining the various types. In 1910, Albrecht and Arzt[6] described the adenolymphoma as a separate neoplasm. Stewart and Foot[7] separated a muco-epidermoid tumor of the parotid gland from the other types.

*Material.*—Our material consisted of 25 pleomorphic adenomas (59.5 per cent), 6 adenolymphomas (14.3 per cent), 3 muco-epidermoid carcinomas (7.2 per cent), 3 combined forms of the previously mentioned types of tumors (7.2 per cent), 1 hemangioma (2.4 per cent), 2 lipomas (4.7 per cent), and 2 cysts (4.7 per cent).

*Incidence of Tumors of the Parotid Gland*

| Classification | Number of Cases | Percentage |
|---|---|---|
| Pleomorphic adenomas (mixed tumors) | 25 | 59.5 |
| Muco epidermoids tumors | 3 | 7.2 |
| Adenolymphomas | 6 | 14.3 |
| Combined or transitory forms | 3 | 7.2 |
| Hemangiomas | 1 | 2.4 |
| Lipomas | 2 | 4.7 |
| Cysts | 2 | 4.7 |
| Total | 42 | 100. |

*Age.*—We considered the age of the patient when the tumor first appeared. The oldest patient was 63 years of age, the youngest 1½ months. For both sexes the average age was 36.4 years. The average age of men in our series was 38.5, and that of women 34.7. The decade of greatest incidence covered the ages 26 to 35; 24.4 per cent of our patients fell within this age group. Among women, the decade of greatest incidence was 21 to 30; 7 of 24 of our patients fell into this age group. The third, fourth and fifth decades were the periods of greatest incidence among the men, and the incidence was equal. The foregoing figures agree with those of various authors.

*Sex.*—Twenty-four out of 42 patients were women and 18 were men. This difference in incidence between the sexes is not great—56.4 per cent to 43.6 per cent—but it exists in almost all the published reports on parotid tumors.

*Time Lapse Before Patients Reported to Physicians.*—Surprisingly enough, the men of our series reported to their physicians sooner after the appearance of the tumors than did the women. Children were brought to their physicians very soon after the tumor appeared. One patient appeared twenty-three years after the tumor's appearance. The shortest time lapse was three weeks.

*Side Affected.*—In 23 of the patients the left parotid gland was affected, and in 18 patients, the right. In 1 case the condition was clinically bilateral, but only one side was operated upon. The predominance of tumors of the left side in this series is entirely insignificant.

*Chief Complaint.*—In all 42 cases, "a lump" supplied the reason for the patient's seeking medical attention. Pain was present in 10 (23.8 per cent) of the lumps. The patients described either a sharp, sudden pain or an ache or tenderness. Seven of the 10 lumps were mixed tumors, 2 were adenolymphomas and 1 was a large cyst. As far as the pathogenesis of the pain was concerned, in only 3 cases was a possible explanation suggested—2 of adenolymphoma and 1 of mixed tumor. The first patient had a history of repeated otitis. In the second patient, pain was caused periodically by obstructions of the salivary flow and was relieved when the flow was restored. The mixed tumor was attached to the bone and the masseter muscle.

*Size.*—The average tumor was 2.25 cm. in diameter. Of all the tumors of the series, the large ones were either more malignant or the patients had permitted a longer time to elapse before having them operated upon. Of 3 tumors invading

Fig. 1 (Case 15).—*A*, chondroid tissue from a pleomorphic adenoma (×215). At the left upper corner islands of epithelial cells are present, which are not yet dispersed. *B*, lymphoid germinal center in a pleomorphic adenoma (×100).

muscle or bone, all were large, and 2 of them were the most malignant type. Correlating the malignancy with the size, we observed that tumors demonstrating the most definite malignant characteristics, both clinically and microscopically, were

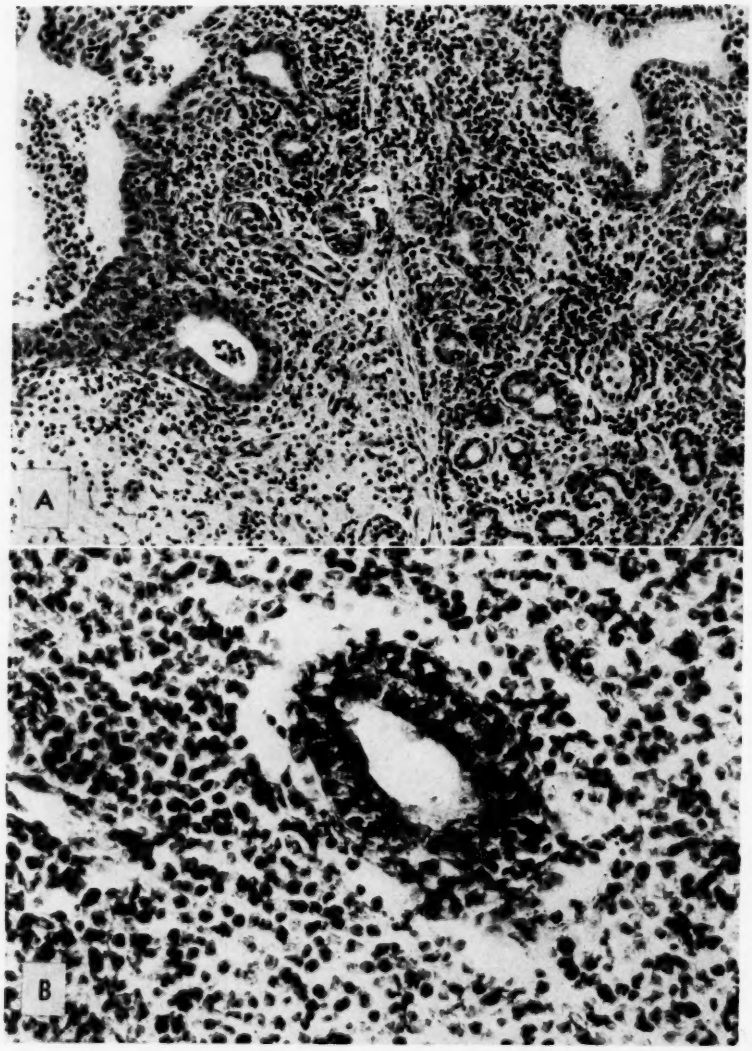



Fig. 2 (Case 30).—*A*, solid form of adenolymphoma in an infant in author's series (× 175). Both the epithelial and the lymphoid components are present. The epithelium is only at places typical of this kind of tumor. (*By courtesy of Dr. Palmer, pathologist at Children's Hospital, Denver, Colorado*). *B*, (Case 1), solid adenolymphoma in an adult (×430). The epithelial element here is more developed toward the typical epithelium of this tumor.

the large tumors of the series.

*General Symptoms.*—None of the tumors, with the exception of a fatal one, produced any general symptoms. No changes in blood values were demonstrable. In 1 patient there was twitching of the homolateral eyelids, and branches of the facial nerve were observed to be incorporated in the tumor.

*Rate of Growth.* — The most rapidly growing tumors were the 1 hemangioma, 2 adenolymphomas, and a mixed tumor

(Case 26) which was the most malignant of the mixed tumors.

*Pathologic Description.*—1. *Mixed Tumors*: Grossly, the mixed tumors appeared to be encapsulated, nodular (1 or more), firm or even hard, or rubbery. On section, they were glistening, meaty white with areas of semitransluscency. Cutting of the cartilage-like areas gave the characteristic impression. Microscopically (Fig. 1), pleomorphism was the characteristic feature. The tumors consisted of two elements: (1) the epithelial element in glandlike formations, islands, or strands, and (2) the interstitial element, consisting of a large amount of pale, mucine blue, amorphous material in which were scattered singular cells, sometimes spindle-like or stellate and sometimes like cartilaginous cells. In other series there were elements resembling nerve tissue. In some series, even osteoid tissue was observed. The components of the mixed tumors vary in percentage; when one of the elements is predominant, it gives the character to the particular tumor.

2. *Adenolymphomas*: These tumors are usually encapsulated, but in 2 cases there was no capsule whatsoever. They were cystic or solid. Grossly, they were lobulated and yellowish. On section, the cystic type showed cystic spaces. Microscopically (Figs. 2 and 3*A*), if solid, they showed two elements—an epithelial element forming ducts, acini or even small cystic spaces, and the stroma. The lining of the spaces consisted of two layers. The basal layer was shorter and rather cuboidal; the layer toward the lumen consisted of columnar epithelium. The stroma consisted of lymphoid tissue showing germinal centers. The cystic form was characterized by papillary formations in the cystic spaces, which were very large and could be seen even grossly.

3. *Muco-Epidermoid Tumor*: The muco-epidermoid tumor is grossly either encapsulated or not, and it may be either cystic or solid. Microscopically, in this series (Fig. 3*B* and 4*A*), the tumor showed squamous metaplasia of the glandular ducts which can be multistratified. Large numbers of prickle cells and epithelial pearls were included in the stroma. Around the epithelial elements large amounts of mucine secretion were observed. The muco-epidermoid tumor is sometimes mistaken for a sebaceous cyst, but it will take the mucin carmine stain.

4. *Combined Forms*: In Case 7 all three forms of tumor were present, but the growth was predominantly muco-epidermoid. In Case 14 there was a mixed tumor with epidermoid elements (cornification). In Case 36 a mixed tumor with muco-epidermoid elements was present. Since this study was completed, another patient has been operated upon, and for a mixed tumor with muco-epidermoid changes.

5. *Lipoma*: The lipomas were encapsulated and showed grossly all the characteristics of its type. Microscopically, they consisted of adult cells of fat tissue.

6. *Cysts*: The linings of cysts displayed epidermoid characteristics.

7. *Capillary Hemangioma* (also called hemangioendothelioma): Grossly, the hemangioma was a lobulated mass of reddish gray tissue. Histologically, we saw the normal tissue in the parotid gland replaced in varying degrees by angiomatous tissue of capillary structure with occasional cavernous spaces. The endothelium, which was hyperplastic, was observed in more or less solid structure between capillaries. Careful examination showed that these cell masses formed minute capillaries. Normal mitotic figures were observed in many fields.

*Malignancy.*—The criteria of malignancy were considered the following: (1) metastasis (Fig. 5*B*), (2) recurrence, (3) recent rapid growth, (4) invasion of the capsule (Fig. 4*B*), (5) invasion of the adjacent parotid gland, (6) invasion of blood vessels (Fig. 5*A*), (7) large cells, (8) abnormal or increased mitotic figures, (9) increased staining of the protoplasm, (10) predominance of epithelial elements and (11) anaplastic cells.

*The Mixed Tumors*: Seven of the mixed tumors of this series were malignant. Six

of these, or approximately 25 per cent, were recurrent. The tumor in Case 6 presented increased mitotic figures and atypical cells. The tumor in Case 8 was recurrent and showed invasion of the capsule; the tumor in Case 12 and the one in Case 17 were recurrent; the mixed tumor in Case 26 was recurrent, adhered to muscle and bone, presented increased mitotic figures, grew rapidly, was metastatic, had large cells and ended in death. In Case 29 there was a recurrent tumor that invaded blood vessels, grew rapidly and presented hyperchromatic cytoplasm and large cells. The tumor in Case 38 was recurrent and invaded blood vessels. These cases represent 28 per cent of all mixed tumors in the series.

*Muco-epidermoid Tumors*: All the muco-epidermoid tumors of this series showed malignant features. The tumor in Case 5 was recurrent and showed adherence to muscle and bone, invasion of the capsule, invasion of blood vessels, some mitosis, and large hyperchromatic cells. The tumor in Case 21 had invaded the capsule and blood vessels. In Case 37 the tumor had invaded the capsule, the adjacent gland and the blood vessels. This last tumor was 100 per cent malignant.

*Adenolymphoma*: The tumor in Case 1 showed invasion of the adjacent parotid, invasion of the capsule and rapid growth. In Case 30 the tumor showed rapid growth but no capsule. The patient was a child.

*Combined Forms*: In Cases 7 and 36 there was invasion of the capsule. In the fourth case of combined form of tumor, which has not been incorporated in this series, vascular invasion was also present.

*Procedure.*—In 4 out of 42 cases—almost 10 per cent—sacrifice of branches of the seventh cranial nerve was necessary. In 12 cases out of 42, almost 30 per cent, there was operative rupture of the capsule of the tumor. In 54.8 per cent of the cases enucleation was performed. Resection *en bloc* was performed in 26.2 per cent. Parotidectomy was done in 4.7 per cent of the cases, and resection in pieces in 14.3 per cent.

*Etiologic Factors.*—In the patients' history or in the adjacent parotid gland, we tried to find such factors as antecedent infection, obstruction of the salivary flow or chronic inflammation in the adjacent parotid tissue. The patient in Case 1, who had an adenolymphoma, had also a history of infection and obstruction, or a chronic inflammation in the adjacent parotid tissue. The patient in Case — also with an adenolymphoma, had a history of infection and obstruction of the salivary flow. In Cases 13 and 30 the patients, who both had adenolymphomas, recounted histories of infection. In Case 21 the tumor was a muco-epidermoid growth showing chronic inflammatory changes of the surrounding parotid tissue. In Case 32 a mixed tumor was present, and the patient had a history of infection.

We cannot consider infectious parotitis a possible factor, as not all the histories included it. Nevertheless, it is not considered a pathogenic factor.

## COMMENT

I. *Pathology and Malignancy.*—1. The pleomorphic adenomas or mixed tumors, according to prognosis, can be divided into three groups: (a) benign, (b) borderline or doubtful, and (c) malignant. A description of the pleomorphic adenomas (a) has been included in the foregoing description of our material. Borderline tumors (b) are characterized by atypical or hyperchromatic cells or by cells larger than usual. Malignant tumors (c) show the following features:

1. *Metastasis*: One tumor out of 42, or 2.4 per cent, has so far shown metastatic lesions. Generally, metastasis is rare in this kind of tumor, but when it occurs it is a very grave omen. The only fatal tumor in our series showed systemic metastases just before death. If the recurrence rate were correlated with metastasis in these tumors, the former could be said to represent a much earlier stage of the neoplasm and the latter a far advanced stage. The patient with systemic

Fig. 3 (Case 2).—*A*, cystic adenolymphoma with papillary formations in the cystic spaces (×175). The epithelial lining consists of a basal layer of cuboidal cells and a superficial layer (towards the lumen) of cylindric cells. The nuclei of the latter are the apices of the cells, which is characteristic of nonfunctioning secretory cells. *B* (Case 37), cystic space (×350) of mucoepidermoid carcinoma in a woman 53 years old. Large amounts of keratin are seen in the stroma. The lining on the right consists of flattened cells, and a metaplastic transition from the normal epithelium (on the left) to the squamous type (on the right) is obvious.

metastases was the only one whose tumor showed general symptoms of malignancy. McFarland[8] reported a very few cases of malignant mixed tumor which killed the host without metastasizing, and in all of these cases the tumor occurred very early

in life. The usual sites of metastasis are the lungs, the cervical nodes, the liver, the kidneys and the adrenals. There is a report of 1 case in which the tumor had metastasized to the dura mater.

2. *Recurrence*: This is generally the most accepted positive feature of malignancy in these tumors. In Case 38 there have been 7 recurrences, the intervals between them gradually shortening. In Case 29 also there is evidence that late recurrences occur after shorter intermissions than do early ones. The latest recurrence, in Case 26, occurred twenty-three years after the primary tumor was removed. The earliest, also in Case 26, was the one that took place before death and six months after the most recent operation. The average time between recurrences in this series, six to seven years, agrees with McFarland's figures.[8] With regard to McFarland's statement that small tumors recur more frequently than large ones,[3] McNealy and McCallister[9] have said that this situation probably results from the smaller incisions and the resultant inadequate exposure, or from the fact that some tumors have a small surface swelling that masks a much greater depth. There might also be small tumors in juxtaposition to larger tumors.

3. *Presence of a Capsule*: This is not always evidence that the tumor is limited by the capsule. There are cases in which no capsule exists.

4. *Invasion of the Capsule*: This is observed in 25 per cent of the cases and is a factor supporting the statement with regard to the nature of malignant tumors.

5. *Invasion of Blood Vessels*: This was present in approximately 12 per cent of the cases. The metastatic lesions in the lungs in Case 26 were evidence of this invasion of blood vessels.

6. *Invasion of the Parotid Gland*: This was present in 12 per cent of the cases.

7. *Increased Mitotic Figures or Abnormal Mitoses*: These were considered to indicate deviation of the tumefying process toward malignancy.

8. *Greater Size*: In this series the size of the tumors was proportionate to the degree of malignancy and the incidence of recurrence.

9. *Other Histologic Evidence*: Hyperchromatic cytoplasm or anaplastic forms were considered indicative of malignancy.

10. *Adherence to Bone, Muscle, or Dimpling of the Skin*: These were considered as malignant features. We had 1 case in which there was dimpling of overlying skin. In the literature, cases of ulceration are reported.

11. *Rapid Growth*: This is usually observed in the most malignant neoplasms.

1. *Conclusions.*—All three of our mucoepidermoids tumors showed definite malignant characteristics, and almost all of the characteristics described for the mixed tumors except the metastasis. Their histologic features and their clinical behavior impose separate classifications.

2. Adenolymphomas are considered rare. Only 64 cases were reported in the literature before 1942. Our series included 6 cases. As no death or recurrence has ever been reported, the malignancy of these tumors is questionable, although occasionally they show infiltration of the capsule, invasion of the parotid gland or absence of a capsule. There is no doubt that they are tumors, since they have definite neoplastic features. Four of the patients with adenolymphomas were men and 2 were women. The average age of the adults in our series was 52.

3. Of three combined forms, 2 showed invasion of the capsule.

4. The epidermoid cysts are not malignant.

5. The capillary hemangioma is a benign tumor despite occasional rapid enlargement or absence of a capsule.

6. The lipomata of the parotid preserve the benign character of their kind.

7. There are several classifications of mixed tumors, but Willis'[10] is, to our thinking, the best, and is given under Section III in this discussion.

II. *Etiology.* Such factors as antecedent infection, obstruction of salivary flow and chronic inflammation seem to play a considerable role in the causation of adeno-

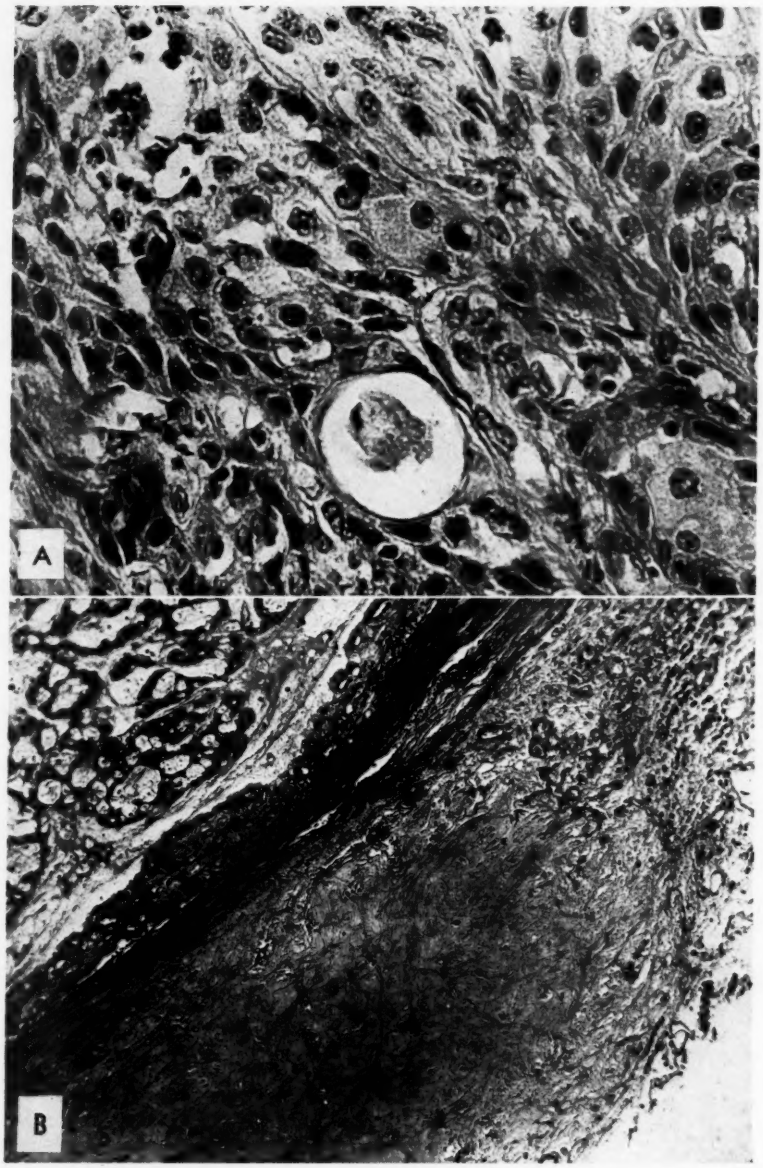



Fig. 4 (Case 37).—*A*, Mucoepidermoid carcinoma showing an epithelial pearl among prickle cells (×690). *B* (Case 15), pleomorphic adenoma invading its capsule (×100).

lymphoma. These etiologic factors were present in 3 of the 6 cases of adenolymphoma in our series. We could discover no such factors in the rest of the tumors.

III. *Histogenesis.* There are two ac-

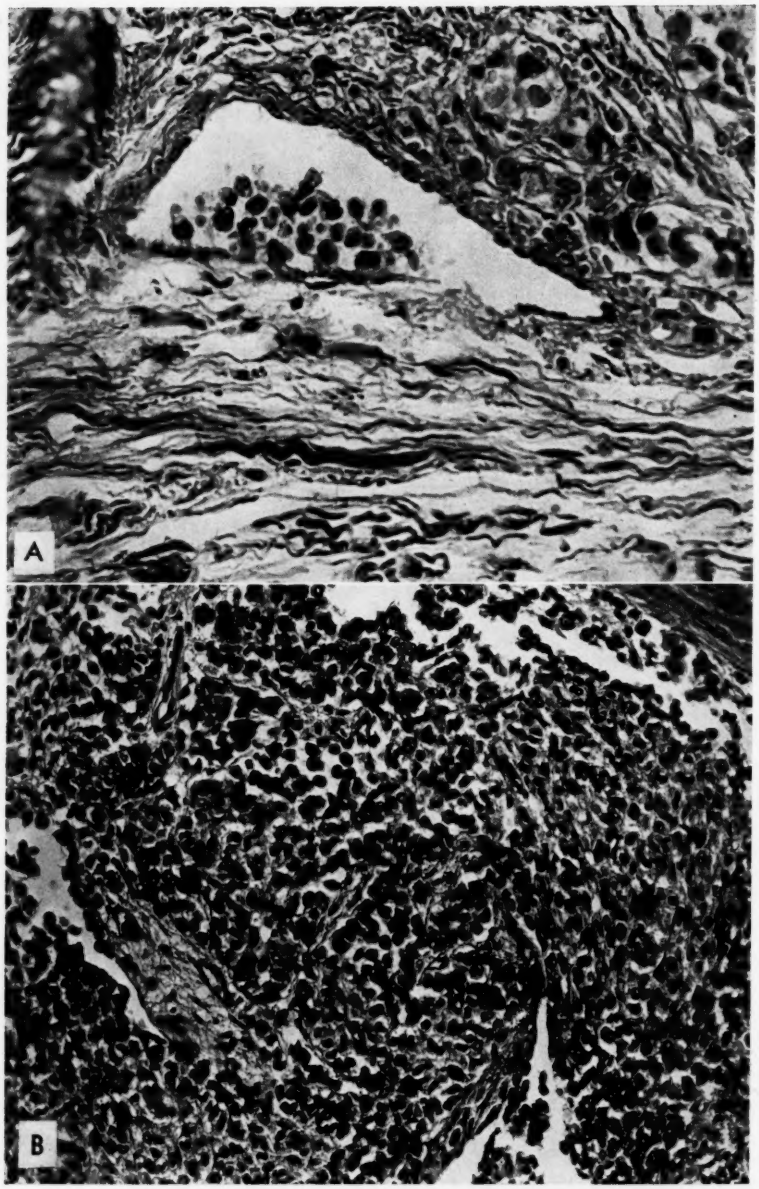



Fig. 5 (Case 26).—*A*, cylindromatous type of pleomorphic adenocarcinoma (×380) showing neoplasmatic cells invading a blood vessel. At autopsy, pulmonary metastases were observed. *B*, pulmonary metastasis, (× 220). Photomicrograph taken after autopsy.

ceptable histogenic theories as to tumors of the parotid gland. The most generally accepted theory is that the growths have a parotid and epithelial origin; the other is that they have an embryonic source. There are strong reasons to believe that adenolymphomas arise from the parotid gland tissue. The arguments for the epi-

thelial origin of the parotid tumors are:

1. The similarity of the parotid adenolymphoma to the fetal parotid as it is shown in the embryology of Neisse.

2. The single case of adenolymphoma in an infant in our series showed complete absence of a capsule.

3. Definite areas of transition from normal parotid tissue to all the types of tumors were found (Figs. 6 and 3*B*).

4. The etiology found in the 3 cases of adenolymphoma described in II. The muco-epidermoids, according to Stewart and his co-workers, arise from the epithelial lining of the ducts of the parotid gland.

5. We have had cases in which more than one neoplastic entity, was present—a combined mixed tumor with muco-epidermoid characteristics, or a muco-epidermoid tumor with adenolymphoma. These cases suggest transition. Under the microscope we have observed fields that included, on the one hand, epithelial tissue of mixed tumor or cartilage-like tissue, and on the other some cystic spaces lined with adenolymphoma-like epithelium and some with squamous lining. Around the cystic spaces there were prickle cells, epithelial pearls and germinal centers of lymphoid tissue. We have also had a case of muco-epidermoid carcinoma in which there were adenolymphomatous components in one field. Willis[10] listed the following nine types of structure that represent evolution, probably retrograde:

a. Nearly normal-looking salivary tissues.
b. Atypical glandular tissue.
c. Atypical glandular tissue with marginal epithelial sprouting.
d. Solid epithelial formations.
e. Epithelial formations with cystic spaces.
f. Cornifying stratified epithelial structures.
g. Epithelial filaments and networks in a mucinous matrix.
h. The so-called cartilage-like tissue.
i. Areas frankly carcinomatous.

Experimentally,[11] the changes observed in the epithelium of explants of tumors are the same as those in explants from normal salivary tissue.

Parotid tumors arise from different areas at different times, a fact that accounts for the multicentric growths in 2 of our cases. The tumor in Case 12 consisted of two nodules of different size, and that in Case 31 of three nodules, also of different sizes. In both cases the nodules were separate from one another. Case 42 suggested the same condition. Mayo and Dockerty[12] have reported 4 such cases, with the tumors occurring in the submaxillary gland.

Muco-epidermoid tumor, as has been mentioned, seems to be an altogether separate entity as regards behavior, although the histogenic background is common with those of all parotid tumors.

IV. *Prognosis.*—The criteria for prognosis are clinical or histologic. Recurrence is generally considered evidence of malignancy, and when it is rapid the prognosis is worse. Metastasis, of course, indicates the worst prognosis. The histologic prognosis has been considered doubtful so far in the history of these tumors. McFarland,[8] sending "doubtful cases" to 20 competent pathologists, got only 52 per cent correct prognoses. In our criteria of prognosis, certain characteristics of cells, such as increased size, increased chromophilia, increased mitotic figures, and so forth, have been considered suspect. The period of time of follow-up of our cases does not permit confirmation of those criteria.

McFarland published interesting percentages of frequency of recurrence of the various types of mixed tumors. In his series, 38 per cent was the recurrence rate between interstitial or simple mixed tumors without suspected elements, 66 per cent between cylindromas, 50 per cent in the semicanalicular, 60 per cent of the epithelial type. The highest percentage of recurrence, 81.8 per cent, was noted with the papillary canalicular type, which percentage is even higher than that associated with the carcinomatoid.

*Treatment.*—The only treatment of parotid tumors is surgical. The roentgen treatment, after long probation, has been rejected as impotent. The only types of

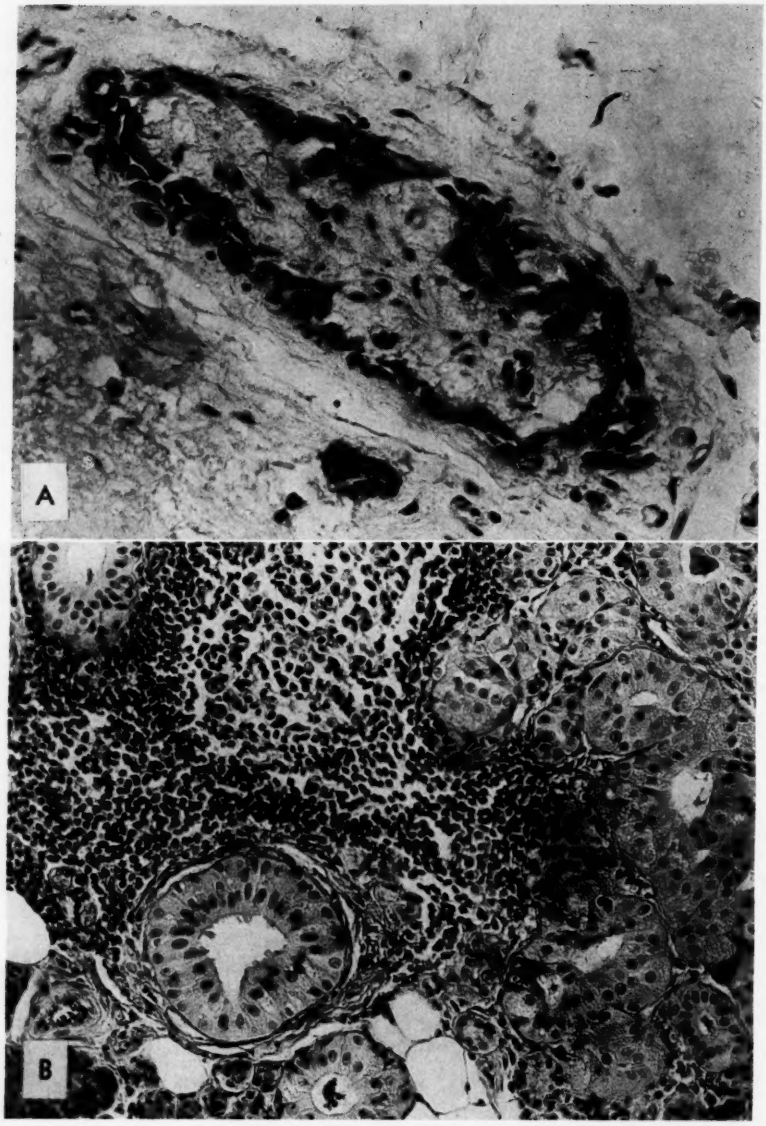



Fig. 6 (Case 16).—*A*, pleomorphic adenoma displaying a change of epithelial elements to myxomatous structures (×400). *B* (Case 37), area of structures resembling adenolymphoma, observed in a muco-epidermoid tumor (×175).

tumors of the parotid gland in which it is sometimes still in use are the cylindroma, a mixed tumor, and the adenolymphoma, and even with these the results are very doubtful. The vital importance of the anatomy, in view of the relative rarity of parotid gland surgery, can never be overemphasized. The procedures and indications are very controversial. The tumors, when of known malignancy, should without a doubt be treated radically.

If primary, but with the absence of a capsule, they should be treated with superficial lobectomy. If they are primary and

apparently encapsulated, the question will be, "Which procedure is eligible?" The simple enucleation is not satisfactory for several reasons: (1) Because the capsule often is thin, the effort results in rupture, which happened in 30 per cent of our cases. (2) Seven out of 28 of our pleomorphic adenomata and muco-epidermoids microscopically showed invasion of the capsule or of the adjacent parotid tissue. (3) The frozen section, if positive of invasion, is acceptable, but a negative report does not rule out the possibility of invasion. (4) One must always remember that the tumor may be multicentric. We have had two such cases proved and one debatable. (5) We have also had one case showing transition in the adjacent parotid gland without invasion of the capsule. (6) There is a high incidence of recurrences.

We have long debated whether superficial lobectomy or resection *en bloc* should be the choice. The former is entirely satisfactory for eradicating the tumor, but the percentage of seventh nerve injuries given by its defenders is depressing.

All things considered, the best procedure is resection *en bloc*, 0.5 cm. away from the capsule, with combined sharp and blunt dissection with tonsil scissors and with sudden pressure of the nerve-like structure. Therefore, the indications for resection *en bloc* are tumors which are non-recurrent, non-metastatic, apparently encapsulated, and histologically non-malignant.

A superficial lobectomy should be done if there is no capsule and injection of saline between the lobes, as suggested by State, (32), is of value. Total parotidectomy should be performed if there is a history of malignancy, if the tumor is deep, or if the tumor is histologically malignant.

McNealy[9] gives the following misconceptions and fears: (1) Fear of facial palsy. (2) Fallacy of waiting for the tumor to grow larger. This latter attitude was suggested by McFarland, who said that small tumors are more apt to recur than large ones. (3) Fear of an ugly scar. (4) Fear of salivary fistula. According to McNealy, rarely or never does a salivary fistula develop after removal of large portions of the parotid. A persistent fistula should suggest a persistent tumor. (5) The diagnosis of pre-auricular lymph node is sometimes a cause of delaying operation. (6) The diagnosis of "cyst" is sometimes a cause for delay also. (7) Roentgen treatment should never be given.

SUMMARY

The authors observed transition from the normal glandular epithelium of the parotid gland to the epithelial elements of the pleomorphic adenoma, the muco-epidermoid carcinoma and the adeno-lymphoma. They also observed transition from one of these three forms of tumor to another. They have adopted the term "pleomorphic adenoma" as descriptive of both the pathologic features and the histogenetic origin.

The incidence of operative rupture of the tumor capsule during enucleation is very high, as is the incidence of recurrence. Resection *en bloc* should replace enucleation.

RÉSUMÉ

Les auteur ont observé le passage de l'épithélim glandulaire normal de la glande parotide, en un épithélium pathologique, soit d'un adénome polymorphe, soit d'un carcinome muco-épidermoïde, soit enfin d'un adénolymphome. Ils ont également observé le passage de l'une de ces trois tumeurs en une autre. Ils ont adopté le terme de "pleomorphic adenoma" pour décrire aussi bien le terme pathologique que l'histogénèse.

Pendant l'opération, la rupture de la capsule tumorale est très fréquente, ce qui provoque des récidives. La résection *en bloc* devrait remplacer l'énucléation.

ZUSAMMENFASSUNG

Die Verfasser konnten einen Übergang normalen Drüsenepithels der Ohrspeicheldrüse in die epithelialen Elemente des pleomorphen Adenoms, des mukoepidermoiden Karzinoms und des Adenolym-

phoms beobachten. Auch eine Umwandlung einer dieser drei Geschwulstformen in eine andere konnte festgestellt werden. Die Verfasser wählen die Bezeichnung "pleomorphes Adenom," weil sie sowohl die pathologischen Kennzeichen als auch den histogenetischen Ursprung wiedergibt.

Verletzungen der Geschwulstkapsel während der Enukleierung und Rückfälle kommen sehr häufig vor. Die Enukleierung sollte durch Resektion *en bloc* ersetzt werden.

RESUMEN

El autor observó transición del epitelio glandular normal de la glándula parótida a los elementos epiteliales del adenoma pleomórfico, carcinoma mucoepidermoide y adenolinfoma. Tambien observó la transición de una de estas tres formas de tumor a una de las otras. Ha adoptado el término de adenoma pleomorfico como descriptivo de los hallazgos patológicos y el origen histogenético.

La incidencia de ruptura operatoria de la cápsula tumoral durante la enucleación es muy alta, así como el grado de recurrencia. La resección en bloque debe substituir a la enucleación.

RIASSUNTO

L'autore ha studiato le zone di transizione fra l'epitelio normale della parotide e gli epiteli dell'adenoma poliomorfo, del carcinoma muciparo e dell'adenolinfoma. Ha studiato, inoltre, le forme di passaggio fra questi 3 tipi, ed ha proposto il termine di "adenoma pleiomorfico" per indicare così gli aspetti anatomici come quelli istogenetici. Vi è una grande frequenza di rotture della capsula del tumore durante la enucleazione e di recidive dopo asportazione. Meglio ricorrere alla asportazione in blocco.

REFERENCES

1. Virchow, R.: Die Krankhaften Geschwulste, Vol. 1, Sechzente Vorlesprung, p. 502.
2. Ehrich, E.: Beitr. z. Klin. Chir. **51**:368, 1906.
3. McFarland, J.: Surg., Gynec. & Obst. **76**:23, 1943.
4. Chevassu, M.: Rev. de Chir. **41**:145 and 450, 1910.
5. Ewing, J.: Neoplastic Diseases. Philadelphia: W. B. Saunders Company, 1940. 4th ed.
6. Albrecht, H., and Arzt, L.: Frankfurt. Ztschr. f. Path. **4**:47, 1910.
7. Stewart, F.; Foot, F., and Becker, W.: Ann. Surg. **122**:520, 1945.
8. McFarland, J.: Am. J. M. Sc. **203**:502, 1942.
9. McNealy, R., and McCallister, J.: J. Internat. Coll. Surgeons **13**:489, 1950.
10. Willis, R.: Pathology of Tumors. St. Louis: The C. V. Mosby Company, 1948.
11. Zymbal, W.: Beitr. z. Path. Anat. u. z. Allg. Path. **91**:193, 1933.
12. Dockerty, M., and Mayo, C.: Surg., Gynec. & Obst. **74**:1033, 1942.
13. Bailey, H.: Brit. M. J. **1**:404, 1947; J. Internat. Coll. Surgeons **8**:109, 1945; Brit. J. Surg. **2**:337, 1941; J. Internat. Coll. Surgeons **12**:103, 1949.
14. McCormack, L.; Cauldwell, E., and Anson, B.: Surg., Gynec. & Obst. **80**:620, 1945.
15. Foot, N.: Pathology in Surgery. Philadelphia: J. B. Lippincott Company, 1945.
16. Marshal, S., and Miles, G.: S. Clin. North America **27**:501, 1947.
17. Kennon, R.: Brit. J. Surg. **9**:76, 1922.
18. Dahlberg, A.: J.A.M.A. **124**:503, 1944.
19. Brown, J.: Ann. Surg. **109**:1016, 1939. Brown, J., and others: Surg., Gynec. & Obst. **90**: 257, 1950.
20. Pung, S.: Am. J. Clin. Path. **22**:1153, 1952.
21. Kirklin, J.; McDonald, J., and Harrington, S.: Surg., Gynec. & Obst. **92**:721-733, 1951.
22. Ackerman, L.: Arch. Path. **36**:508-511, 1943.
23. Adson, A., and Ott, W.: Arch. Surg. **6**:739, 1923.
24. Ahbom, A.: Acta Radiol. **1**:452 (supp. 23), 1935.
25. Hamperl, H.: Ztschr. Mikr. Anat. Forsh. **27**:1-55, 1931; Virchow's Arch. f. path. Anat. u. f. allg. Path. **298**:327, 1936.
26. McKnight, H.: Am. J. Surg. **45**:128, 1939.
27. Mikulicz, J.: Med. Classics **2**:165, 1937.
28. Rawson, A.; Howard, J.; Royster, H.; Horn, R. and Cory, C. E.: J. Cancer **3**:445, 1950; Surg., Gynec. & Obst. **90**:307, 1950.
29. Stein, I., and Geschickter, C. F.: Arch. Surg. **28**:892, 1934.
30. Warthin, A.: Cancer Research **13**:116, 1929.
31. Halpert, B., and others: Cancer Research **7**:333, 1947. Halpert, B., and others: Arch. Path. **43**:559-565. 1947.
32. State, D.: Surg., Gynec. & Obst. **89**:237, 1949.
33. Quattlembaum, F.; Dockerty, M., and Mayo, C.: Surg., Gynec. & Obst. **82**:342, 1946.
34. Aschoff, L.: Path. Anat. Spezieller Teil, 1909.
35. Leroux, Leroux-Robert, and Dilange, Bull. Assoc. France p. l'etude du cancer **22**:1, 1933.
36. Berner, A.: Acta. Med. Helv. **9**:650, 1942.
37. Boetner, O.: Beitr. path. Quart. **68**:364, 1921.
38. Carmichael, R.; Davie, T., and Stewart, M.: J. Path. & Bact. **40**:601, 1935.
39. Fry, R.: Brit. J. Surg. **15**:191, 1928.
40. Harvey, W.; Dawson, E., and Tunes, J.: Edinburgh M. J. **45**:275, 1938.
41. Skoerpil, F.: Virchows Arch. f. path. Anat. u. J. Allg. Path. **306**:714, 1940.
42. Godwin, J.: Cancer **6**:1089, 1952.

# Retropubic Prostatectomy

FRANCIS A. BENEVENTI, M.D., F.A.C.S., F.I.C.S.

NEW YORK CITY, NEW YORK

## I. Surgical and Vascular Anatomic Background

IN considering the anatomic character of the prostate as related to prostatectomy, certain structures, because of their close relation to the prostate, become involved in the operation and therefore require careful study. These structures are the external urinary sphincter, the prostatic portion of the urethra, the true prostatic capsule, the prostatic sheath, the internal vesical sphincter and the triangular ligament.

*Prostate.*—The human prostate gland closely resembles a large Spanish chestnut in size, shape and surface smoothness. The term itself is derived from the Latin "pro-status" meaning to "stand before" (the seminal vesicles). Its average weight is between 16 and 22 Gm. It is roughly 1 inch (2.5 cm.) in thickness, length and breadth. Histologically it is made up of branching tubular glands embedded in a densely woven fibromuscular stroma which cannot be dissected away and which has a reaction to estrogenic stimulation differing from that of smooth muscle elsewhere in the body. The apex of the prostate rests on the superior layer of the triangular ligament, and its base is continuous with the neck of the bladder.

The *prostatic portion* of the urethra penetrates the anteroposterior diameter of the gland, is spindle-shaped and is normally about 3 to 4 cm. long. The juncture of the floor of the urethra with the floor of the bladder neck is referred to as the posterior commissure and the juncture of the bladder and urethra at the roof is known as the anterior commissure. On the floor of the prostatic portion, at its widest part, is an elevation termed the verumontanum, the summit of which is occupied by a small blind pouch known as the utriculus prostaticus. On either side of the utriculus are the openings of the ejaculatory ducts, the patulency of which plays a role in the production of epididymitis. Circular muscle fibers around these ducts are said to prevent regurgitation of urine into the vasa and seminal vesicles. On the urethral floor, between the verumontanum and the bladder neck, are the tiny openings of some 50 to 60 prostatic ducts.

*Lobes of the prostate*: For many years the human prostate was considered a bilobular organ no different from that of the dog, the beaver and the large black ape; in fact, it was referred to as the prostate "glands" because each lobe had its own seminal vesicle, vas and testicle and was completely separated from its mate. The middle lobe was discovered by Sir Everard Home in 1806, and the accessory subcervical lobes were first described by Albarran and Motz almost a hundred years later, in 1902. It was not until 1912 that Lowsley clarified the anatomic and embryologic aspects of the human prostate. His fundamental work, which was beautifully illustrated with wax models, proved the existence of 5 prostatic lobes; 2 lateral, 1 median, 1 anterior and 1 posterior. Lowsley's discovery of the posterior lobe of the prostate was most illuminating in the early detection of cancer of the prostate. Huggins and Webster have recently demonstrated a biologic difference between the posterior lobe of the prostate and the rest of the gland. This careful work categorized the 5 true lobes of the prostate and the 2 accessory lobes (the subcervical and the subtrigonal).

Read at two presentations at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.
Submitted for publication Oct. 19, 1953.

*True Prostatic Capsule.*—This is not to be confused with the sheath of the prostate, which is derived from the endopelvic fascia. The true capsule is part of the prostate itself. It is a very thin, ill-defined membrane that sends projections down into the gland substance and, unlike the capsules of other organs (such as the kidney and spleen) it cannot be stripped off without lacerating glandular tissue. It is a difficult structure to demonstrate in either a normal or a hypertrophied gland, and there is no distinct fascia separating the prostate from the bladder. Some make no distinction between the sheath and the capsule; others hold that the venous plexus separates the two structures. My own opinion is that the venous plexus lies above both structures and that there is no plexus between capsule and sheath. As early as 1856 Ellis found no true prostatic capsule and concluded from this that the prostate was not a separate organ but part of the circular muscle of the bladder surrounding the urethra. Among others, Albarran and Motz concluded that the prostate had no true capsule. Van Duzen and his associates went so far as to regard the prostate not as a separate organ but simply as the glandular portion of the neck of the bladder. Most of the early anatomists (Stoney, Cameron, Campbell, Smith and Moullin) looked upon the sheath of the prostate as its capsule.

*Prostatic Sheath.*—As the pelvic fascia reaches the inferior margins of the prostate where the levator ani (levator prostati) lends support, the fascia thickens suddenly to form the prostatic sheath, which completely covers the anterior and lateral surfaces of the gland. It is a thick fibromuscular jacket, open at both ends, and is replaced on the posterior surface of the prostate by Denonvilliers' fascia. The sheath is made up of a large amount of smooth muscle tissue and some striated fibers. The latter are scarce in the proximal portion, but as the fibers descend distally and inwardly they decussate over the anterior surface of the gland to form a thickened band of striated muscle in the membranous portion of the urethra. This muscular nature of the sheath plays an important role in contraction of the prostatic envelope after prostatectomy. The distal end of the sheath is continuous with the superior layer of the triangular ligament.

The proximal portion of the sheath is firmly adherent to the lower end of the bladder and fits snugly around its neck like a collar 1 cm. wide, completely encircling the neck save for a small portion on the undersurface. As it sweeps upward over the bladder, the capsular sheath thins out and becomes lost in connective tissue. At the lateral margins of the prostatic bed the sheath fuses with the lateral edges of Denonvilliers' fascia, and it is here that the sheath is firmly adherent to the gland, while the anterior and lateral surfaces can be readily stripped away from the prostate. Loosely woven connective tissue stroma, in which is embedded many small veins and lobules of fat, overlies the prostatic sheath. The lateral walls of the sheath are covered by the dense plexus of prostatic veins.

On the anterior surface of the sheath, at a variable position usually distal to the midpoint on the prostate, the insertions of the puboprostatic ligaments or the anterior true ligaments of the bladder are received. These are paired, one on either side of the midline, originating in the backs of the pubic bones near the arch. Although the puboprostatic ligaments show thickenings of the endopelvic fascia, they are almost wholly composed of smooth muscle (see accompanying illustration). Early surgeons looked upon the puboprostatic ligaments as the pubic bone attachments of the detrusor muscle.

The part played by these ligaments in stress incontinence varies, according to different authors. Sundberg expressed the opinion that fixation of the bladder to the symphysis produces incontinence of urine, and therefore recommends cutting these ligaments. Marshall, Marchetti and Krantz cured stress incontinence in a large series of cases by doing just the opposite; they fixed the neck of the bladder to the symphysis with sutures.

*Internal Vesical Sphincter.*—Although most volumes on anatomy describe an internal urinary sphincter, its presence has long been a controversial point. This question was naturally first brought up with the advent of prostatectomy at the turn of the century. In 1907, Ball performed perineal prostatectomy on a patient in whom he had damaged the membranous urethra and noted that there was no fistula five days later, indicating that the internal urinary sphincter was intact. He also presented experimental evidence of the presence of an internal sphincter in dogs by destroying the membranous portion of the urethra without impairing continence. Born injected plaster of Paris into the bladders of live dogs and human cadavers via the ureters and noted that when small amounts were injected there were no casts of the posterior portion of the urethra, but when the bladder was filled with plaster and the tension of the detrusors equaled that of the internal sphincter, the latter gave way and a cast of the prostatic portion of the urethra was also formed. From this he concluded that an internal muscle is present and that it remains in a state of involuntary tonicity. Thomson-Walker passed a small catheter beyond the external sphincter, so that its tip lay in the prostatic fossa, and observed that sometimes he obtained urine and sometimes did not. He also noted that at times the prostatic cavity was empty while the bladder was full, and also that when the bladder was empty no urine remained in the prostatic fossa. R. A. Moore suggested that the beneficial effects of prostatectomy may be the result of destruction of the internal sphincter rather than the removal of 50 or 100 Gm. of prostatic tissue.

*Triangular Ligament.*—This is a firm, inelastic barrier that stretches across the inferior rami of the pubic bones just below the arch of the symphysis and measures about 4 cm. from top to bottom. Its horizontal measurement varies with the angle of the pubic arch. It does not cover the entire space as it stretches from bone to bone but leaves a small gap between its upper margin and the arcuate ligament. Through this opening pass the deep dorsal vein of the penis with its accompanying nerve and artery; all other perineal structures must pass through the triangular ligament in order to reach the pelvis. It is composed of two fascial layers between which are the deep transverse perineal muscles, the external urethral sphincter muscle of the membranous portion of the urethra and the body of Cowper's gland.

The *external urethral sphincter* is composed of striped muscle and envelops the urethra at the membranous portion like a collar. It is sometimes referred to as the compressor urethra muscle (Henle).

The inferior fascia of the triangular ligament is a very strong layer, which, after stretching across the space between the pubic bones, becomes continuous with Buck's fascia as the latter invests the bulb and the corpora of the penis. The upper end of the triangular ligament is open and free of fascial attachments, while its base becomes continuous with Colles' fascia to form the *superficial perineal pouch*, which is nothing more than the pouch created by the superficial fascia as it dips deep in the perineum above the anus to become continuous with the base of the triangular ligament. Extravasation in the perineum is therefore limited because of this pouch, which is closed behind in front of the anus, closed laterally at the sides of the perineum and open on top and forward into the scro-

The puboprostatic ligaments.

tum and around the spermatic cords.

The *deep perineal pouch* is the space between the inferior and superior layers of fascia of the triangular ligament.

*Vascular Anatomic Picture.—Veins*: In retropubic prostatectomy, the first vessels confronting the surgeon after the prevesical space has been cleared are the many small veins in the fatty tissue on the surface of the prostatic capsule and the many large vessels on the lateral surfaces that comprise the lateral plexus of veins. The former are to be brushed aside or underrun, and the latter are to be shunned. In no other operation on the prostate is there need for dealing with this group of veins.

The year 1947 found a colleague (Noback) and myself ideally situated to carry on a study of the vascular anatomic picture in the male pelvis, especially as applicable to retropubic prostatectomy. However, until plastics became available there was no material, such as Vinylite, that could be used in a liquid state for injection and would crystallize into a firm permanent cast within a day or two at room temperature. There was no other way, it seemed, to carry out properly an anatomic study of the thin-walled, easily torn veins of the pelvic plexus. In dissecting our first cadavers, it was extremely difficult to dissect even a short segment of vein without lacerating it. Separating the entire plexus was impossible. We discovered that by injecting the deep dorsal vein of the penis we could produce a colored plastic mold of the veins in the pelvis.

The veins in the pelvis, like those anywhere else in the body, are subject to considerable variation. The *deep dorsal vein of the penis* enters the pelvis from the perineum by passing under the arcuate ligament of the pubis and over the edge of the triangular ligament. This vessel and its accompanying nerve and artery are the only structures that do not penetrate the triangular ligament to reach the pelvis. It is through this space around the vein that free blood in the retropubic space can find its way into the perineum. Clinically this is manifested as ecchymosis around the shaft of the penis, scrotum and perineum. When the extravasation is more extensive, the large ecchymotic area conforms to the fascial limits of the superficial perineal pouch.

*Trifurcation of the Deep Dorsal Vein of the Penis*: On entering the pelvis over the apex of the prostate gland, the deep dorsal vein of the penis immediately trifurcates into two large lateral veins (right and left) and a smaller superficial or median branch. Each of the lateral veins divides into several smaller veins as they hug the prostate and sweep around its lateral walls. This comprises the *lateral venous plexus of the prostate.* Here it is joined by the pudendal veins, which are the main trunks into which venous blood from the scrotum and perineum is poured. There is free communication between the lateral and the pudendal plexus of veins. Branches are also sent to the lateral plexus by the rings of veins around the external rim of the obturator foramen. This is the *obturator plexus,* which consists of two rings of veins, one large and one small. The larger ring forms a larger oval than the obturator foramen, with its base resting on part of the quadriceps femoris muscle and the top arc resting on the pectineus muscle. It is more superficial than the smaller one. The small ring rests on the surface of the external obturator muscle and receives its branches from the larger ring around it. It collects venous blood from the upper part of the thigh and receives a considerable amount from near the acetabulum. It gives off emptying branches of considerable size to both the lateral and the pudendal plexus.

*Vesical Plexus*: As the lateral and pudendal plexuses continue upward to surround the inferior lateral surfaces of the bladder, branches are received from the anterior and lateral surfaces of the bladder, the seminal vesicles, the lower parts of the ureters and the hemorrhoidal vessels. Smaller parietal branches come from the levator ani muscles. Like the plexus around the prostate, the vesical plexus is a dense mass of veins firmly held together by rather loose pelvic fascia and connective tissue. This group of many

veins fuses sharply into two or three larger veins, which become the roots of the internal iliac veins.

The *superficial branch of the deep dorsal vein of the penis* or median vein drains the distal half of the bladder and empties into the deep dorsal vein as it emerges into the pelvis under the pubes. Parietal branches are received from the backs of the pubic bones as well as the smaller visceral branches near the prostatovesical juncture. It is the first large vein to confront the surgeon during exposure for retropubic prostatectomy. It is quite large, lies just left of the midline in loose fatty tissue and is easily retractable without laceration. Descending from the lower third of the bladder, it increases in size on its downward course. On the surface of the prostate it attains considerable size and soon dips down into the pocket between the puboprostatic ligaments.

*Veins on the Surface of the Prostate*: A small group of small veins lies in a fatty pad of loose areolar tissue on the anterior surface of the sheath of the prostate and empty directly into the lateral plexus on each side. These vessels have no communication with the anterior surface of the prostatic sheath, for in the great majority of instances they can be gently brushed aside with a wet stick sponge. In the occasional case one cannot retract the vessels and their fatty cushion without opening these veins. In such instances the vessels are underrun with a suture ligature.

*Arteries.*—There are only two true arteries to the prostate gland, the inferior vesical and the middle hemorrhoidal. Both are direct branches of the internal iliac. The internal pudendal artery, which is also a branch of the internal iliac, is often described as part of the blood supply to the prostate, but I am not completely reconciled to this. It sends blood to the transverse perineal muscle, bulb and triangular ligament and penis, and rarely does it send a branch however small to the prostate.

The *middle hemorrhoidal artery* gives off a branch to the lower ureter shortly after it originates from the internal iliac artery. This is the ureteral branch, which is the principal source of bleeding in operations on the lower part of the ureter. In our dissections it was seen as a comparatively large artery spiraling up the lowest 2 inches (5 cm.) of the ureter. The middle hemorrhoidal artery is an irregular branch that may arise from the internal iliac or even from the inferior vesical artery. It proceeds forward, giving off branches to the seminal vesicles and the upper part of the vas deferens to form an anastomosis with the superior and inferior hemorrhoidal arteries. A small branch is given off to the base of the bladder before it terminates as a tiny vessel in the base of the prostate. This is the small vessel sometimes seen below the mucous membrane at the posterior commissure after the prostate has been removed. Although it is tiny, it is sometimes quite distinct, but never, to my knowledge, has it been the source of serious hemorrhage. Although the middle hemorrhoidal artery plays an insignificant role in supplying blood to the prostate gland, it is the only artery on its floor. Once the gland has been enucleated, arterial bleeding from the floor can arise only from the torn end of the middle hemorrhoidal artery at the neck of the bladder. Only on rare occasions does one find a prostatic branch of the internal pudendal artery, and when present it is always minute.

The *inferior vesical artery*, or the "genitovesical artery" of the French, is the principal source of blood supply to the prostate. It is a direct terminal continuation of the visceral half of the internal iliac artery. Arising near the ischial spine, it proceeds forward and downward on the floor of the pelvis (levator ani muscle) to come into contact with the lateral and inferior margin of the bladder. There it gives off its first vesical branch and small branches to the lower part of the ureter and the seminal vesicle, which anastomose freely with branches of the middle hemorrhoidal artery. As it proceeds toward the prostate, three other lateral vesical

branches and an anterior capsular branch are given off from it before it enters the substance of the prostate gland at 5 and 7 o'clock at the prostatovesical juncture. As it pierces the prostatic sheath to terminate in the gland, it gives off the inferior capsular artery.

The *two capsular arteries,* which supply the prostatic sheath and the peripheral surface of the prostate, are both branches of the inferior vesical. The *anterior capsular* artery is a middle branch arising from its parent on the inferolateral surface of the bladder and follows an anterior spiraling course downward, so that, by the time it reaches the vesical neck, it is in a position between 11 and 12 o'clock on the anterior surface of the gland. The *inferior capsular artery* is the last branch to be given off before its parent terminates in the prostate gland. It proceeds downward on the inferior-lateral surface of the sheath to anastomose with the internal pudendal branches to the triangular ligament and the penis. Anomalous arteries to the prostate are rare.

## II. The Operation: Advantages, Technic Postoperative Care and Complications

THE advantages of retropubic prostatectomy over the other types of prostatectomy may be briefly given as (1) the remarkable postoperative comfort of the patient, (2) the minimum degree of shock, (3) the excellent postoperative results and minimum complications and (4) the ease with which the operation can be learned,

1. *Comfort of the Patient.*—This is difficult to describe, but I can think of no better way to emphasize the degree of postoperative comfort than to state that in my first 100 cases of retropubic prostatectomy, 26 per cent of the patients required not a single dose (injection or otherwise) of even a mild opiate, and that another 23 per cent required only a single injection of a mild opiate, such as demerol (50 to 75 mg.) for complete comfort throughout the postoperative course. Even those were given an opiate for precordial pain as long as ten days after the operation were included in the group who received the injection.

This remarkable comfort permits early ambulation, so that most of my patients, in spite of their years, are out of bed within twenty-four or forty-eight hours. The hospital stay in most instances is far less than two weeks, and for one patient it was only five days (this patient wanted to be home for Christmas).

2. *Minimum Degree of Shock.*—Many of these patients cannot stand a great deal of shock; most of them have cardiac damage of some sort (Beneventi and Twinem reported 56 per cent, while Brick and Peters reported cardiac abnormalities in 85 per cent of their cases). I have performed retropubic prostatectomy on quite a few patients who were bad surgical risks and who would undoubtedly be considered by some to be excellent candidates for a two-stage prostatectomy, only to have these patients respond excellently to retropubic prostatectomy and go on to a speedy recovery. Even the "poor risk' patients do not relish a second trip to the operating room, which in itself is enough to lower their morale. The patient gets well to go home, not to go back to the operating room.

3. *Excellent Postoperative Results.*—Complications, particularly at the bladder neck, are avoided or minimized by carefully trimming the vesical orifice at the time of operation. The urine becomes sparklingly clear in about three to five weeks. The prospect of the old bugbear, osteitis pubis, is remote, for it is no more a complication of retropubic prostatectomy than it is of suprapubic and other abdominal operations. Urinary and sexual continence after retropubic prostatectomy remains intact and undisturbed, and injury to the rectum or contiguous struc-

tures is practically unknown.

4. *Ease of Learning the Technic.*—One or more students may watch all steps of the operation at the same time. After scrubbing for several retropubic prostatectomies the novice can quickly grasp the essential features and carry out the operation without too much difficulty. Unlike perineal prostatectomy this procedure involves no fear of injurying the rectal wall, and unlike transurethral prostatectomy, it does not require a long apprenticeship under careful guidance.

*Indications for Retropubic Prostatectomy.*—When does one perform retropubic prostatectomy? A terse answer to this general question is simply, when there is an uncomplicated benign prostatic enlargement (over 25 Gm.) in any patient, whether he is lean or fat. If the prostatic enlargement is complicated by vesical tumor, the situation calls for opening the bladder unless the tumor is small and can be dealt with satisfactorily via the transurethral route. I personally prefer and carry out retropubic prostatectomy in the presence of infected bladder and multiple vesical calculi.

*Estimating the Size of the Prostate*: The preoperative determination of the exact weight of the prostate by any one method is practically impossible. A reasonable estimate of its size serves well in selecting the most suitable type of operation for dealing with the obstruction in question. This can be arrived at by employing a combination of rectal palpation with endoscopic and cystourethrographic examination. The more methods employed for the same patient the more accurate will the estimate be.

*Rectal Palpation*: For rectal examination the patient is placed in the knee-chest position on a table or bed. It is more comfortable for the patient and permits higher insertion of the examining finger. Rectal palpation is valueless in estimating the size of median, subcervical, subtrigonal or anterior lobe enlargement, because none of these can be felt by the finger in the rectum. A combination of lateral lobe hypertrophy plus median or subcervical lobes can be palpated with some degree of accuracy, provided the lateral lobes comprise the principal enlargement.

In the presence of simple lateral lobe enlargement without intrusion into the bladder, the full extent of the lateral lobes can be felt. In this type of hypertrophy the enlargement is lengthwise; the width remains the same. The opposite is true in the presence of middle lobe enlargement (median or subcervical); the breadth is increased and the length remains the same.

The only other lobe that can be completely felt by the rectal finger is the posterior lobe of Lowsley, which presents its entire surface to the examining finger. The importance of the accessibility of this lobe becomes appreciated when one realizes that 75 per cent of all carcinomas of the prostate originate in Lowsley's posterior lobe (Young, Moore, Huggins).

*Cystourethrographic Study*: This is an excellent method of determining the size of the prostate gland, and in many parts of the United States it is preferred over endoscopic study and found to be much more accurate.

For this, two films are taken, both with the patient in the semilateral position so that the innominate bone does not insinuate itself between the roentgen tube and the urethra. The first film is the air cystogram and is taken with a red rubber catheter (radiopaque) and 150 cc. of air in the bladder (injected into the bladder with a handbulb syringe). The catheter is removed, air being left in the bladder, and a section of catheter about 6 inches (15 cm.) long is then inserted into the urethra and held firmly in place with the left hand. With a hand bulb syringe containing opaque medium in the right hand the substance is squeezed into the catheter, forcing open the external urethral sphincter and thereby lining the walls of the posterior urethra with opaque medium and allowing some to enter the bladder. This second exposure is taken during the injection, but not until at least 15 cc. of medium has entered the bladder. This is the urethrogram.

The air cystogram with the catheter in place indicates the status of the floor of the neck of the bladder: whether there is elevation due to median bar, subcervical or median lobe. Normally the catheter should enter the bladder without any deflection. In the presence of elevation of the bladder floor at its neck, there is an anterior deflection of the catheter. Posterior deflection of the catheter signifies prostatic abscess. The soft tissue shadow of the intruding prostate can be seen against the air background of the cystogram.

The urethrogram gives information on the status of the lateral lobes and the presence of carcinoma. As the lateral lobes increase in size and the limit of capsular tension is reached, the lobes press against one another so that the diameter of their touching surfaces is increased, in much the same manner as when two soft rubber balls are pressed against one another. In the semilateral position, the increase in this diameter becomes apparrent and is referred to as "lateral lobe spread" of the prostate. The greater the "spread" the larger the lateral lobes. Carcinoma in the urethrogram is characterized by a thin, irregular, inelastic prostatic urethra.

*Endoscopic Study*: Although this can be dispensed with in contemplating transurethral or suprapubic prostatectomy, it should not be omitted in planning retropubic or perineal prostatectomy. The possible presence of bladder tumors and diverticula make the difference. Both of these complications are amenable to treatment by the suprapubic route, while in the case of transurethral resection the tumor can be resected at one sitting and the diverticula removed at a later sitting. Similarly, retropubic prostatectomy may be carried out as the first stage of the operation and diverticulectomy may then be carried out through a previously unopened bladder as the second stage. The presence of vesical calculi is not a contraindication to retropubic prostatectomy. When stones are too large to pass through the neck of the bladder, the latter can be made large enough to accommodate their passage by making a vertical incision.

*Types of Prostatic Enlargement.*—The following is a simple classification of prostatic enlargement based on pathologic hypertrophy. Each has its own clinical manifestations.

1. Simple lateral lobe.....(bilobar)
2. Median Iobe.....(middle lobe)
3. Subcervical lobe.....(also middle lobe)
4. Lateral lobe plus median lobe .....(horsecollar)
5. Lateral lobe plus subcervical lobe .....(trilobar)

Median bar is not considered here, for actually it is not hypertrophy of the prostate but simply inflammatory hypertrophy of the posterior commissure.

*The Role of Intravenous Urographic Procedures in Determining the Size of the Prostate.* — The excretory urogram is probably the most important single diagnostic device in urology. It gives much information on renal function, especially tubular excretion. The film outlines the bones and soft tissue shadows: it outlines the bladder, and where there is prostatic enlargement a soft tissue shadow is seen on the vesical base line. The ideal type of prostatic enlargement suited for retropubic prostatectomy is the bilobar type in which the bladder sphincter remains intact and firm, thereby preventing intrusion into the bladder of the enlarging prostate and allowing the growing gland to push it and the rest of the bladder up out of the pelvis *en masse*. When this happens, the lower ureters become hook-shaped because they must double back on themselves in order to reach the bladder. This is best demonstrated by the intravenous urogram. In short, when the excretory urogram (twenty or thirty minute film) shows a large soft tissue shadow on the base line of the bladder with hooking of the lower ureters it is pathognomonic of massive lateral lobe enlargement of the prostate without intrusion into the bladder. This is the ideal situation for retropubic prostatectomy; the prostate is large, the sphincter is intact, and both the bladder neck and the prostate are high

and almost out of the pelvis, within easy reach of the surgeon.

On the other hand, the intravenous pyelogram may be misleading, for in many instances one may see a large prostatic soft tissue shadow on the bladder base line which is actually due not to prostatic enlargement but to an hypertrophied trigone. The prostate in these cases is very small.

*Technic.*—Almost every surgeon has a technic of his own. I too have changed from time to time until now, when I believe the technic is simplified. Without going into all the details, I wish to stress the following eight steps, which are most important and contribute greatly to the success or failure of the operation.

1. *Position of the Patient*: The patient is placed on the table with the legs outstretched. The site of operation is thoroughly scrubbed with green soap and water, and the table is tilted into a slight Trendelenburg position. (Just five days ago I operated on a "poor risk" who had cardiac difficulties and was propped up on the table with two pillows under his head and shoulders. This did not interfere with satisfactory exposure.)

2. *Exposure of the Prostate*: Fatty tissue in the retropubic space is brushed aside with a wet stick sponge. No pads are placed in the lateral recesses of the prostate.

3. *Capsular Guy Sutures*: Only 2 are used, one on each side of the midline and both distal to the proposed line of the capsular incision.

4. *The Prostatic Incision*: This is made transversely across the visible dome of the prostate. A vertical incision here is fraught with the danger of extending downward and injuring the external urinary sphincter or extending upward and cutting the internal urinary sphincter.

5. *Hemostasis after Enucleation*: This is mainly dependent on the inherent contractility of the prostatic envelope (capsule and its immediate surroundings). Methods of stimulating capsular contraction are the use of hot packs or hot solutions in the fossa, removal of prostatic remnants and the control of excessive bleeding. One notices that when the adenoma is "cleanly" removed the prostatic fossa contracts immediately. Hemostasis is more easily maintained if hemostatic sutures are taken at 5 and 7 o'clock at the vesical neck in order to ligate the torn ends of the inferior vesical arteries.

6. *Treatment of the Bladder Neck*: The caliber of the vesical orifice is tested for adequacy by inserting a stick sponge or the middle finger into it. If the neck permits passage with ease, it is adequate. If it is constricted, a wedge-shaped piece is excised from the floor at 6 o'clock. Torn pieces of mucous membrane are carefully excised; if they are left behind in the hope that they will slough away, they may act as foci for the development of adhesions and veils across the neck of the bladder.

7. *Urethral Catheters*: Almost any type may be used, depending on the surgeon's inclination. I personally like the open end type. Millin and European surgeons seem to prefer a straight catheter held in place by strappings. Some urologists have performed successful retropubic prostatectomies without the use of any catheter at all (Bond). In the case of 1 of my private patients I removed the catheter after only seventeen hours, with no ill effects. These statements are made simply to stress the fact that there is no hard and fast policy about catheters.

8. *Two-Stitch-Closure of the Capsule*: Only 2 sutures are used for closing the prostatic incision, and for this the original long ends of the guy sutures are used. In my opinion the watertight closure is unnecessary, for there is nothing to recommend it. If the catheter drains well, the bladder will never become full and there will be no seepage through the wound. On the other hand, if the catheter becomes blocked, the two-stitch closure will act as a safety valve for the escape of fluid which might otherwise overdistend the bladder.

*Postoperative Management.* — During the first hour the catheter should be flushed with a hand-bulb syringe every fifteen minutes to make certain there is

The air cystogram with the catheter in place indicates the status of the floor of the neck of the bladder: whether there is elevation due to median bar, subcervical or median lobe. Normally the catheter should enter the bladder without any deflection. In the presence of elevation of the bladder floor at its neck, there is an anterior deflection of the catheter. Posterior deflection of the catheter signifies prostatic abscess. The soft tissue shadow of the intruding prostate can be seen against the air background of the cystogram.

The urethrogram gives information on the status of the lateral lobes and the presence of carcinoma. As the lateral lobes increase in size and the limit of capsular tension is reached, the lobes press against one another so that the diameter of their touching surfaces is increased, in much the same manner as when two soft rubber balls are pressed against one another. In the semilateral position, the increase in this diameter becomes apparrent and is referred to as "lateral lobe spread" of the prostate. The greater the "spread" the larger the lateral lobes. Carcinoma in the urethrogram is characterized by a thin, irregular, inelastic prostatic urethra.

*Endoscopic Study*: Although this can be dispensed with in contemplating transurethral or suprapubic prostatectomy, it should not be omitted in planning retropubic or perineal prostatectomy. The possible presence of bladder tumors and diverticula make the difference. Both of these complications are amenable to treatment by the suprapubic route, while in the case of transurethral resection the tumor can be resected at one sitting and the diverticula removed at a later sitting. Similarly, retropubic prostatectomy may be carried out as the first stage of the operation and diverticulectomy may then be carried out through a previously unopened bladder as the second stage. The presence of vesical calculi is not a contraindication to retropubic prostatectomy. When stones are too large to pass through the neck of the bladder, the latter can be made large enough to accommodate their passage by making a vertical incision.

*Types of Prostatic Enlargement.*—The following is a simple classification of prostatic enlargement based on pathologic hypertrophy. Each has its own clinical manifestations.

1. Simple lateral lobe.....(bilobar)
2. Median Iobe.....(middle lobe)
3. Subcervical lobe.....(also middle lobe)
4. Lateral lobe plus median lobe .....(horsecollar)
5. Lateral lobe plus subcervical lobe .....(trilobar)

Median bar is not considered here, for actually it is not hypertrophy of the prostate but simply inflammatory hypertrophy of the posterior commissure.

*The Role of Intravenous Urographic Procedures in Determining the Size of the Prostate.* — The excretory urogram is probably the most important single diagnostic device in urology. It gives much information on renal function, especially tubular excretion. The film outlines the bones and soft tissue shadows: it outlines the bladder, and where there is prostatic enlargement a soft tissue shadow is seen on the vesical base line. The ideal type of prostatic enlargement suited for retropubic prostatectomy is the bilobar type in which the bladder sphincter remains intact and firm, thereby preventing intrusion into the bladder of the enlarging prostate and allowing the growing gland to push it and the rest of the bladder up out of the pelvis *en masse*. When this happens, the lower ureters become hook-shaped because they must double back on themselves in order to reach the bladder. This is best demonstrated by the intravenous urogram. In short, when the excretory urogram (twenty or thirty minute film) shows a large soft tissue shadow on the base line of the bladder with hooking of the lower ureters it is pathognomonic of massive lateral lobe enlargement of the prostate without intrusion into the bladder. This is the ideal situation for retropubic prostatectomy; the prostate is large, the sphincter is intact, and both the bladder neck and the prostate are high

and almost out of the pelvis, within easy reach of the surgeon.

On the other hand, the intravenous pyelogram may be misleading, for in many instances one may see a large prostatic soft tissue shadow on the bladder base line which is actually due not to prostatic enlargement but to an hypertrophied trigone. The prostate in these cases is very small.

*Technic.*—Almost every surgeon has a technic of his own. I too have changed from time to time until now, when I believe the technic is simplified. Without going into all the details, I wish to stress the following eight steps, which are most important and contribute greatly to the success or failure of the operation.

1. *Position of the Patient*: The patient is placed on the table with the legs outstretched. The site of operation is thoroughly scrubbed with green soap and water, and the table is tilted into a slight Trendelenburg position. (Just five days ago I operated on a "poor risk" who had cardiac difficulties and was propped up on the table with two pillows under his head and shoulders. This did not interfere with satisfactory exposure.)

2. *Exposure of the Prostate*: Fatty tissue in the retropubic space is brushed aside with a wet stick sponge. No pads are placed in the lateral recesses of the prostate.

3. *Capsular Guy Sutures*: Only 2 are used, one on each side of the midline and both distal to the proposed line of the capsular incision.

4. *The Prostatic Incision*: This is made transversely across the visible dome of the prostate. A vertical incision here is fraught with the danger of extending downward and injuring the external urinary sphincter or extending upward and cutting the internal urinary sphincter.

5. *Hemostasis after Enucleation*: This is mainly dependent on the inherent contractility of the prostatic envelope (capsule and its immediate surroundings). Methods of stimulating capsular contraction are the use of hot packs or hot solutions in the fossa, removal of prostatic remnants and the control of excessive bleeding. One notices that when the adenoma is "cleanly" removed the prostatic fossa contracts immediately. Hemostasis is more easily maintained if hemostatic sutures are taken at 5 and 7 o'clock at the vesical neck in order to ligate the torn ends of the inferior vesical arteries.

6. *Treatment of the Bladder Neck*: The caliber of the vesical orifice is tested for adequacy by inserting a stick sponge or the middle finger into it. If the neck permits passage with ease, it is adequate. If it is constricted, a wedge-shaped piece is excised from the floor at 6 o'clock. Torn pieces of mucous membrane are carefully excised; if they are left behind in the hope that they will slough away, they may act as foci for the development of adhesions and veils across the neck of the bladder.

7. *Urethral Catheters*: Almost any type may be used, depending on the surgeon's inclination. I personally like the open end type. Millin and European surgeons seem to prefer a straight catheter held in place by strappings. Some urologists have performed successful retropubic prostatectomies without the use of any catheter at all (Bond). In the case of 1 of my private patients I removed the catheter after only seventeen hours, with no ill effects. These statements are made simply to stress the fact that there is no hard and fast policy about catheters.

8. *Two-Stitch-Closure of the Capsule*: Only 2 sutures are used for closing the prostatic incision, and for this the original long ends of the guy sutures are used. In my opinion the watertight closure is unnecessary, for there is nothing to recommend it. If the catheter drains well, the bladder will never become full and there will be no seepage through the wound. On the other hand, if the catheter becomes blocked, the two-stitch closure will act as a safety valve for the escape of fluid which might otherwise overdistend the bladder.

*Postoperative Management.* — During the first hour the catheter should be flushed with a hand-bulb syringe every fifteen minutes to make certain there is

no obstruction due to clots. When blood clots cease to form, bladder irrigations are dispensed with. From then on the catheter is checked to make certain there is free drainage. As long as there is no obstruction to the free flow of urine from the bladder, the appearance of frankly bloody urine at this stage is inconsequential.

As a rule the patient is fairly comfortable and free from pain and rarely requires more than small doses of demerol or codeine during the first twenty-four hours. After his return to his room he is usually interested in his surroundings and often states that the only uncomfortable part of the operation is the presence of the urethral catheter.

*Blood Loss*: It is my policy to give all patients 500 cc. of transfused whole blood either during or shortly after the operation. The replacement of blood renders the patient better able to resist infection; it elevates his morale and speeds up convalescence by eliminating the long waiting period before the blood levels return to normal.

By giving transfusions to all patients who had sustained a blood loss of 250 cc. or less during a prostatic operation (transurethral resection), Nesbit and Conger were able to show a reduced incidence of postoperative shock and infection.

The blood loss due to retropubic prostatectomy is subject to wide variations. For instance, Goodyear and Beard reported an average blood loss of 640 cc. in a series of 20 patients, while Millin noted an average loss of only 80 cc. in a series of 25 consecutive cases. Millin injected 20 cc. of 1 per cent procaine solution with 0.5 cc. of pitressin into the prostate before enucleation.

*Early Ambulation*: Early ambulation means getting out of bed and walking, not getting out of bed and sitting a chair. According to Dock, the energy exchange of sitting in a chair is not much higher than that of lying in bed so far as basal metabolism is concerned.

Like other therapeutic measures, early ambulation can resemble a double-edge sword and do harm as well as good. The obvious contraindications are hemorrhage or the fear of hemorrhage, cardiac insufficiency and cachexia. The great advantages are that morale is lifted, care is simplified, asthenia is avoided and the incidence of pulmonary complications is lowered.

Patients who move with great effort should not be required to become ambulatory early. For instance, the large, heavy man who feels depleted of physical energy the first four or five days after the operation should be permitted to remain in bed until he feels the desire for bathroom privileges and for short walks to the solarium.

Straining seems to be a real hazard, which the patient should learn to avoid. He should be taught not to close his mouth or glottis while changing position or emptying his bowels. The bed exercises of rolling, turning and stretching are normal during restful sleep.

The effect of early ambulation and bed exercises in reducing the incidence of postoperative thrombosis and emoblism is undisputed. The principal sources of thrombi from which emboli may break off and lodge in distant parts of the body are the veins of the legs and pelvis. In 399 consecutive autopsies performed at the New York Hospital, Dock observed a 5 per cent mortality rate due to pulmonary embolism secondary to thrombi in the legs and pelvis. Hunter and his co-workers dissected the leg veins of 169 postmortem specimens and observed that thrombosis was three times as frequent in those who did not excercise as in those who did.

*Bed Rest*: The harmful effects of bed rest can be summarized as follows. It leads to constipation, abdominal distention, impairment of the appetite, bed sores, loss of muscles tone, wasting, muscle cramps, persistent muscle spasms, loss of calcium from the skeleton, calcinuria, the formation of urinary stones of recumbency and, worst of all, profound depression in morale. It leads to pulmonary congestion in old people and renders them

susceptible to pulmonary embolism due to fragmentation from thrombi of the legs and pelvis. As for comfort, the bedpan is uncomfortable and annoying; reaching for the commode requires less energy.

*Care of the Catheter.*—The comfort of the patient is dependent to a great extent on the patency of the urethral catheter. For the first hour after the operation this is tested by injecting a small hand bulb syringeful of water into the bladder every fifteen minutes until no clots appear in the return. Sometimes when a small blood clot is obstructing the catheter it can be dislodged by suddenly squeezing and releasing the rubber tubing with the fingers. This creates sudden positive and negative pressure, pushing out the clot and sucking back fluid.

Another factor in preventing the formation of clots in the bladder is the free flow of urine from the kidneys into the bladder, where it mixes with blood and passes out of the catheter. This requires a fluid intake of 5,000 cc. per day or more. Fluid given parenterally at the rate of 500 cc. per hour ( a safe rate which will not overburden the heart), will allow between 400 and 500 cc. of urine to be poured into the bladder per hour and will help prevent clotting of blood in the bladder.

*Removal of the Catheter*: Ordinarily, the catheter is removed any time after the fifth postoperative day. My rule is to withdraw it on the sixth or seventh day. Before it is removed, however, the bladder is filled with a measured quantity of sterile water. After the catheter is out, the patient is told to empty his bladder into a graduated jar. In this way a rough estimate of the amount of residual urine can be made (this of course is not absolutely accurate). It also is an index to the effectiveness of the urinary sphincter.

Should the catheter drop out of the urethra spontaneously after the first day, the patient is given a voiding test (if the urine is not too bloody). If, after being without a catheter for five or six hours, the patient is still unable to void, or if there is leakage through the abdominal wound, a small catheter, preferably a No. 16 or 18 F. is passed into the bladder and strapped in position. If he is able to void, the catheter remains out.

The reinsertion of the urethral catheter during the first few days of the postoperative period carries danger of infection. Catheterization must be carried out under the strictest asepsis. In most of my patients in whom postoperative meatal strictures and epididymitis developed, the urethral catheter had to be reintroduced.

*Care of the Bowels.*—On the second or third day the patient may be given a mild cathartic, such as milk of magnesia or cascara sagrada. Enemas are forbidden during the first twelve days because of the danger of injuring the rectal wall. Although this danger is admittedly small, it should not be overlooked.

Abdominal distention or meteorism is not often seen in patients who have undergone prostatectomy. When it does occur, it disturbs the smooth convalescence of the patient and interferes with firm healing of the abdominal wound.

If gentle catharsis fails to relieve abdominal distention I administer 20 cc. of a 10 per cent hypertonic solution of sodium chloride intravenously, using a small needle, so that it requires five minutes to complete the injection (4 cc. per minute). This method is not only highly successful but can be done with impunity. Frequently the patient will pass flatus during the injection. This is repeated in twenty-four hours if a satisfactory bowel movement does not occur or if the abdominal distention persists.

*Follow-Up.*—When the patient leaves the hospital, he is instructed to return to the outpatient department or the office, as the case may be. He is watched for complications, and particular attention is paid to the clearness of the urine. Sloughing of the prostatic fossa goes on for three or four weeks. During this time the urine is usually muddy and full flakes. If muddy urine perists for four weeks, he is given mandelamine, terramycin or aureomycin plus gantrisis to hasten the clearing of the

urine. To test the patency of the urethral canal and bladder neck, a No. 24 F. sound is passed on the twentieth day, and meatal strictures are enlarged by meatotomy whenever they are found. If the urine does not clear during this period the bladder is irrigated with a 1:5,000 solution of oxycyanide of mercury once a week.

*Postoperative Complications.*—The attentiveness of the surgeon has a great deal to do with the smoothness of the convalescence and the avoidance of complications. For instance, to obtain consistently good postoperative results it is essential to make certain that all remnants of prostatic tissue and mucous membrane are trimmed off the neck of the bladder to preclude the formation of strictures, to test the adequacy of the bladder neck, and to remove a bar, if one is present, in order to guard against an unnecessary secondary transurethral resection later. Gentle handling and careful hemostasis are always desirable. If the surgeon stresses speed of execution and passes lightly over the details outlined here, strictures, persistent infection, draining sinuses, dysuria and other complications will disturb the patient and plague the surgeon.

*Hemorrhage at Operation*: It does not seem possible to perform prostatic enucleation without loss of blood. When the prostatic mass is shelled out of its capsule many small vessels are necessarily torn, with the result that bleeding must occur. The control of bleeding from the prostatic fossa during the operation is dependent on the inherent contractility of the capsule, which can be augmented by packing the prostatic cavity with hot pads. Arterial bleeders obviously must be ligated. These occur only at the neck of the bladder; they present no problem, because of the marvelous accessibility of the vesical outlet in the retropubic exposure.

*Reactionary Bleeding*: Bleeding when the patient reacts to the anesthetic and operation occasionally occurs. It is not serious if the surgeon has properly sealed the inferior vesical arteries.

*Secondary Bleeding*: This is the type of hemorrhage that occurs after the third day. In three of my patients it occurred on the eleventh, twelfth and fifteenth day. In each case, simple emptying of the bladder of clots was all that was necessary.

The most frequent cause of secondary hemorrhage is infection with sloughing in the prostatic bed; it causes small vessels to reopen, and these continue to ooze blood into the prostatic fossa and bladder. When the fluid intake is low, the catheter may become blocked and the bladder may fill with blood clots.

*Meatitis*: This is frequently observed in conjunction with urethritis. When present, it is accompanied by a reddened, swollen frenulum and an edematous prepuce retraction of which causes painful paraphimosis. If only for this reason, careful inspection of the penis should be made when the patient complains of pain or burning in that region. Inspection not infrequently reveals paraphimosis, which is reversible in the early stage. In circumcised patients only the portion of the prepuce around the frenulum may become swollen and edematous.

*Stricture of the Neck of the Bladder*: The incidence of stricture at this point has been variously reported. Some routinely remove a wedge of tissue from the neck of the bladder to preclude this possibility. I personally do not. I have removed a wedge in only 9 per cent of my cases with an incidence of stricture of only 1 per cent, and this was amenable to office treatment alone without operation. The highest incidence of stricture of the vesical neck following retropubic prostatectomy was that reported by Wilhelm and Freed (27 per cent), yet they routinely removed a wedge of tissue.

*Thrombophlebitis and Phlebothrombosis*: It is well recognized that thrombosis may occur at any time in the life of man, whether he is operated on or not. As a matter of fact it occurs more frequently in medical bed patients than those who have undergone operations. Pelvic surgical procedures have a relatively high incidence of postoperative thrombosis, but in prostatic operations the incidence is notorious-

ly high because of the proximity of the dense, sluggish prostatic plexus of veins.

*Embolism*: This may take place after any type of prostatic operation, because of the direct communication of the periprostatic veins with the right side of the heart. In visceral operations the veins empty into the portal circulation, and pulmonary emboli are rare because they are arrested and absorbed by the liver. Most embolisms are precipitated by raising the venous pressure of the lower part of the body, e. g., such as by sudden strains, climbing and sitting up. When the venous pressure is raised, the lumen of the vein enlarges, the walls bulge and the entire thrombus or part of it is peeled loose and carried away in the venous return to the right heart and lungs.

Pulmonary embolism occurs more frequently than clinical records indicate. Emboli that have produced no clinical signs or symptoms in the living patient, and therefore have gone unrecognized, have been discovered at autopsy in a large percentage of cases. In a survey of more than 8,000 urologic operations, Culp noted that embolism had been responsible for 6.6 per cent of all postoperative deaths. Cardiac embarrassment, overweight and age were given as prominent factors.

*Ecchymosis of the Penis, Scrotum and Perineum*: This is due to the escape of small amounts of blood from the prevesical space into the superficial perineal pouch via the small space between the upper edge of the triangular ligament and the arcuate ligament on the undersurface of the arch of the pubis. It is usually seen after difficult enucleations, i. e., of small fibrotic glands, in which excessive prodding of the finger against the steady triangular ligament and pubic bone is required to shell out the gland.

The ecchymosis follows the limits of Colles' fascia in the penis, scrotum and perineum, where it is attached to the lower limits of the descending rami of the pubic bones, anterior to the anal margins. By occupying the superficial perineal pouch, extensive extravasation can extend along the spermatic cords, over the suspensory ligament and even onto the abdomen.

The bluish discolorations of extravasated blood first appear at the base of the penis on the second or third day after operation, extend along the shaft of the penis and then proceeds into the scrotum and perineum. Like ecchymosis elsewhere, this condition lasts from seven to ten days and has never been more serious than simple ecchymosis. There has been no complication such as abscess or slough, and the condition may be regarded as one of little consequence aside from its academic interest.

*Suprapubic Urinary Fistula*: Permanent fistulas following retropubic prostatectomy are rare. When present, they are observed in the early postoperative period, just after the removal of the catheter, and can be quickly sealed by keeping an indwelling catheter in position for several additional days. I have known fistulas to close without reinsertion of the catheter: a patent and adequate vesical outlet is all that is necessary.

*Incontinence of Urine*: Temporary incontinence, exclusive of neurogenic dysfunction, may follow the surgical removal of the obstructing prostate by any method. Davis ascribed it to the preoperative weakness or atrophy of the external sphincter after a long period of disuse. Systematic sphincteric exercises shorten the period of incapacity. Flaque's method of having the patient start and stop his stream is effective. I test the continence of my patients by filling the bladder with oxycyanide of mercury, after which the patient is instructed to walk about the treatment room with his urethral sphincter in as great a state of contraction as possible. At the same time he watches the floor for drippings. After several minutes he is instructed to empty his bladder by starting and stopping his stream. If he is able to stop his stream perfectly, I am certain of a permanent cure. Permanent incontinence (of more than six months duration) may follow any type of prostatectomy and has occurred once in my first 100 cases.

*Impotence*: The many known and unknown factors involved in impotence make

it a difficult thing to evaluate. Usually men who have been active sexually before operation retain their powers. Those who were not active may experience a renewal of the sex drive. A return of potency is also observed after other types of prostatectomy and may be due to the feeling of well-being that follows removal of the prostatic obstruction.

*Osteitis Pubis*: In the first 100 cases there were 2 instances of osteitis pubis following retropubic prostatectomy. One patient was diabetic, the other an arthritic patient who had no pubic tenderness. Osteitis pubis may follow any operation and has occurred without a preceding surgical history. Oddly, the incidence of osteitis pubis rose during the advent of retropubic prostatectomy in this country. Not only did it follow retropubic prostatectomy, but it occurred with greater frequency than ever before after suprapubic prostatectomy. As Vest and Rosenberg stated, "After many years of suprapubic prostatectomy and no osteitis pubis, why the great frequency now?" Similar experiences were reported in this country and England. Osteitis pubis was reported as following uncomplicated transurethral resection and perineal prostatectomy.

Experimental attempts by Wheeler at producing osteitis pubis in rabbits met with no success. Similar unsuccessful attempts were reported by Beneventi and Spellman, who attempted to reproduce the lesion in dogs.


## SUMMARY

The author recommends retropubic prostatectomy over other types of prostatectomy for numerous reasons, including the patients comfort, the minimal surgical shock, the excellent postoperative results and the lack of difficulty in learning the technic. The indications for this operation as outlined, together with suitable diagnostic measures. The operative technic is presented in detail.

A detailed description of the surgical and vascular background for retropubic prostatectomy is included.

## RÉSUMÉ

L'auteur recommande la prostatectomie rétro-pubienne parmi les autres méthodes pour plusieurs raisons: bien-être du malade, choc chirurgical minime, résultats post-opératoires excellents et technique facile. Les indications pour cette opération sont données dans les grandes lignes ainsi que les moyens de diagnostic. La technique opératoire est exposée en détail.

## ZUSAMMENFASSUNG

Der Verfasser gibt der retropubischen Prostataresektion den Vorzug gegenüber anderen Operationsmethoden. Zu den zahlreichen Gründen dafür gehören die Annehmlichkeit für den Kranken, die Geringfügigkeit des chirurgischen Schocks, die ausgezeichneten operativen Ergebnisse und die Leichtigkeit des Erlernens der Technik. Die Indikationsstellungen für diese Operation und geeignete diagnostische Massnahmen werden angegeben. Die Operationstechnik wird mit allen Einzelheiten dargestellt.

## RESUMEN

El autor recomienda la prostatectomía retropúbica sobre otros tipos de prostatectomía aduciendo numerosas razones que incluyen la comodidad del paciente, el choque quirúrgico mínimo, los excelentes resultados postoperatorios y la falta de dificultad en el aprendizaje de la técnica. Se delínean las indicaciones para esta operación, junto con los medios diagnósticos adecuados. Se presenta en detalle la técnica operatoria.

## RESUMO

O autôr recomenda a pratica da prostatectomia retro-pubiana que julga melhor, por inumeros motivos, que as demais técnicas adotadas, salientando um maior confôrte para o doente, mínimo choque operatório, excelentes resultados operatórios, e a facilidade técnica para sua

pratica.

Esquematisa a indicação para essa operação, e bem assim os meios propedeuticos a sêrem empregados no diagnostico dos diferentes casos. Conclue apresentando em detalhes toda a técnica cirúrgica das prostatectomias retro-pubianas.

RIASSUNTO

Viene raccomandata la prostatectomia retropubica, a preferenza di ogni altro metodo, in quanto è la meglio sopportata dal paziente, la meno traumatizzante, la più feconda di eccellenti risultati, la più facile da imparare. Vengono elencate le indicazioni, i metodi per la diagnosi, la tecnica operatoria.

REFERENCE

Beneventi, F. A.: Retropubic Prostatectomy. Springfield, Ill.; Charles C Thomas, Publisher, 1954.

In 1535 the French explorer Jacques Cartier was on an expedition to Labrador when a disease which proved to be scurvy—that ancient enemy of soldiers and sailors—broke out among his crew. In a short time all but ten of his men were desperately ill and twenty-five had died. The French, in their distress, set up an image of Christ upon the shore and prostrated themselves before it in the deep snow, chanting litanies and penitential psalms. The pestilence continued unabated, however, until the French learned from the Indians that they might be cured by a decoction made from the needles of spruce trees. Such a decoction was accordingly made and the results were almost miraculous. Scurvy disappeared immediately. An enthusiastic writer, describing the effects of this decoction, said that if "all the doctors of Montpellier and Louvain had been there with all the drugs of Alexandria, they would not have done so much in a year as that tree did in six days."

Cartier's great discovery had no effect at all in checking the ravages of scurvy in the armies and navies of the world. They continued to sicken and die of the same disease which even crusaders in Palestine had found more deadly than the attacks of the Saracens. How different would the story be today! If the soldiers and sailors of today were being decimated by scurvy, and a returned explorer from the arctic told how he had been cured of the disease, the news would be flashed around the world the following day, and within a week every little fishing schooner which put out to sea would carry a small cargo of spruce trees in its hold. It is also probable that some enterprising merchant would attempt to corner the market in spruce trees, and that some member of Congress would make a speech denouncing this commercial exploitation, while some irate Englishman gave vent to his feelings in a letter addressed to *The Times*.

—*Ralph H. Major*

# Hamartoma of the Hand

TIMOTHY A. LAMPHIER, M.D., F.A.C.S., F.I.C.S.

BOSTON, MASSACHUSETTS

BY definition, a hamartoma is a tumor-like malformation of congenital origin. The term is a broad one, encompassing many types of malformation. Of necessity, therefore, any report of its occurrence must be accompanied by a description of the location and histologic subdivisions of the tumor. A hamartoma is not a true neoplasm. Actually, this type of tumor is made up of an abnormal mixture of the various tissues or elements which normally constitute that part of the body or organ in which the tumor takes its origin. Hamartomas have been reported as occurring in the lungs, kidneys, spleen, gastrointestinal tract, liver and other sites.

The case I am reporting is unusual in that the tumor occurred in a hand. The only other case described in the literature as such was reported from the Mayo Clinic.[1]

Hamartomas were first described in 1904 by Albrecht.[2] The word "hamartoma" originates from the Greek word meaning "to fail" or "to err." In Albrecht's opinion such tumors represent malformations or failures of normal development of the organ in which they are located. This abnormal development may consist of changes in "arrangement, differentiation, and quantity of the mixture of the tissues comprising the tumor."

As a rule hamartoma occurs in the lungs.

## REPORT OF A CASE

A 33-year-old unmarried man of Boston was admitted to the Sancta Maria Hospital of Cambridge, Massachusetts, because of swelling of the right hand of about three

Submitted for publication Jan. 9, 1954.

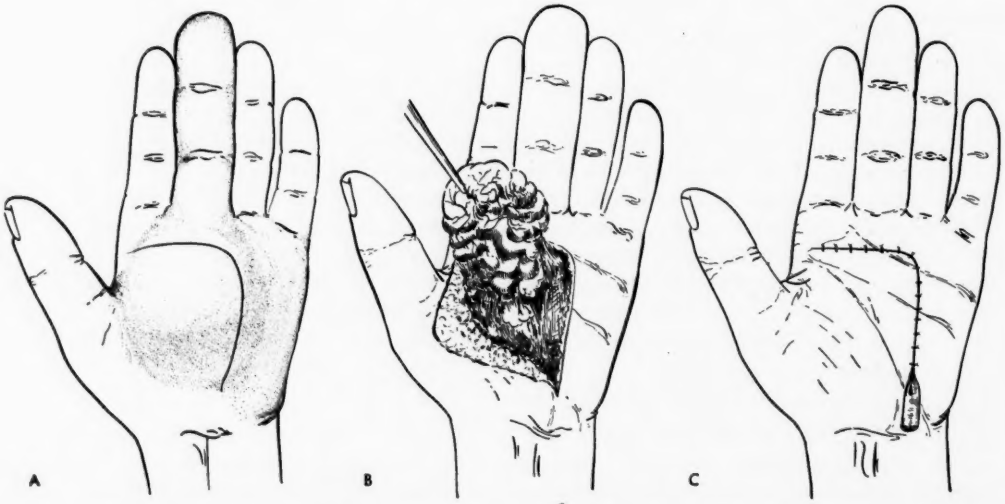



Fig. 1.—*A*, tumor mass occupying most of palmar surface of hand. *B*, excision of tumor. *C*, artist's conception of extent of tumor and drain in place after closure of the skin flaps.

years' duration. He had undergone tonsillectomy at the age of 9 and had had scarlet fever at 10. His history included no other major illnesses or operations. He had 4 brothers and 3 sisters, all in good health. His mother was alive and well, but his father had died of heart disease in 1946. There was no family history of tuberculosis, diabetes or hypertension. His mother had undergone an operation for carcinoma of the rectum one year prior to his admission.

A systemic review was carried out. The head showed no deformities. The eyes reacted to light and accommodation. The ears, nose and throat were free from inflammation or discharge. The trachea was in the midline, and no adenopathic condition could be detected.

The peripheral pulsations were good. Cardiac examination showed the point of maximum impulse to be in the fifth intercostal space. There was normal sinus rhythm, with no murmurs and no thrills.

In the respiratory tract, both lung fields were clear to percussion and auscultation. The abdomen revealed no tenderness, and no masses could be palpated. The gastrointestinal and genitourinary tracts were normal.

The patient complained of hardening of the palmar skin and the aforementioned tumor-like mass of three years' duration, which had gradually become larger but was neither tender nor painful. He had been forced to submit to an operation when he was no longer able to "make a fist" and his work as a garage mechanic had been hampered thereby to the extent of inefficiency.

The value for hemoglobin was 15.05 Gm. (96 per cent). The white blood cell count was 8,400 per cubic millimeter, with 69 per cent neutrophils, 29 per cent lymphocytes, 1 per cent large monocytes and 1 per cent eosinophils. The erythrocyte count was normal.

*Operation.*—With adequate pentothal anesthesia and with the patient in the dorsal recumbent position, the right hand was cleaned with phisoderm and zephiran and properly draped. The procedure had been carried out with a pneumatic tourniquet above the right elbow. A sterile stockinette was then placed over the hand, after which a Bunnell-type incision was made in the palm, i. e., a C-type incision, was made in the hand so that a flap of skin could easily be elevated, revealing the tumor masses which overlay the palmar fascia, but also extended below the fascia (Figs. 1, 2 and 3).

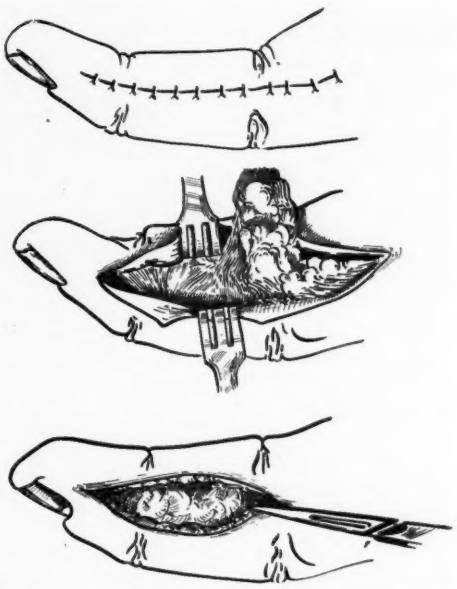


Fig. 2.—Artist's diagram showing incision, excision and closure of digit involved by extension of tumor mass.

By sharp dissection these tumor masses were excised. The branches of the ulnar nerve were easily preserved. It was noted that there were two components of the tumor, the larger of which extended toward the dorsum of the hand. The skin flap was then approximated with interrupted black silk sutures and a small Penrose drain inserted. A longitudinal incision was made along the ulnar aspect of the right long finger.

The flap was then elevated. The tumor mass, which involved the ulnar side of the finger as well as its anterior aspect, was then excised by sharp dissection. Skin flaps were approximated with interrupted black silk sutures. Petrolatum gauze dressings were then applied over the palm and long finger of the hand and a throat stick splint to the right long finger. A pressure-type dressing was applied and reenforced with an ace bandage (Fig. 4).

The pathological report described the specimen as "an irregular piece of fibrofatty tissue, 6.5 by 4 by 2.5 cm., which upon palpation contains nodules of firmer tissue, 0.5 to 2 cm. in diameter. Some of these nodules appear fusiform and connected. Multiple sections show them to be similar in appearance,

Fig. 3.—Photomicrograph of tumor specimen (see text).

having a multicystic structure, the cysts being 1 mm. or less in diameter. The surrounding tissue is tan or white, firm, tough and homogeneous. These nodules appear to be encapsulated. They are not markedly congested." Microscopically the seven sections presented a similar appearance. In the fibrofatty tissue there were numerous capillary, cavernous and large thick-walled (arterial? venous?) vascular channels growing in a haphazard and purposeless manner. Some of the larger channels showed thrombosis with organization. In some areas there was a "myxoid" character in the walls of the vessel or in the tissue of the surrounding stroma.

The final diagnosis was "hamartomatous formation of blood vessels." The lesion appeared to conform better to the concept of a hamartoma (i. e., abnormal mixture, overgrowth and composition of elements indigenous to a tissue) rather than a true vascular tumor or neoplasm. The great disparity in size and appearance of the vessels, i. e., capillary and large vascular channels or large veins, is not the usual picture of a hemangioma.

Slides were reviewed and the consensus of pathologists agreed with the aforementioned diagnosis. It was concluded that some of the vessels were arteries and others veins.

SUMMARY

Hamartomas are benign tumors formed by an abnormal mixture of the constituent elements of the organ in which they take origin. They may occur in any part of the body. The histologic picture is varied. A case is reported of a hamartoma of the hand.

RÉSUMÉ

Les hamartomes sont des tumeurs bé-

nignes constituées par un mélange anormal des éléments de l'organe dans lequel elles prennent leur origine. Ils peuvent survenir dans n'importe quelle partie du corps. Leur image histologique est variée. L'auteur rapporte un cas d'hamartome de la main.

ZUSAMMENFASSUNG

Hamartome sind gutartige Geschwülste, die aus einer anormalen Mischung von Gewebsbestandteilen des Organs, in dem sie entstehen, gebildet sind. Sie können überall im Körper vorkommen. Das histologische Bild ist verschiedenartig. Es wird ein Fall von Hamartom der Hand berichtet.

RESUMO

Os homartômas são tumôres benignos formados por uma mistura anormal dos elementos constitutivos do orgão no qual êles têm origem, podendo se desenvolver em qualquer parte do corpo.

O seu quadro histologico é variado. O autôr relata um caso de homartôma da mão.

RESUMEN

Los hamartomas son tumores benignos formados por una mezcla anormal de los elementos constitutivos del órgano del cual se originan. Pueden ocurrir en cualquier parte del cuerpo. Su imagen histológica es variada. Se comunica un caso de hamartoma de la mano.

RIASSUNTO

Gli amartomi sono tumori benigni in cui gli elementi che entrano nella costituzione dell'organo di origine si mescolano anormalmente. Essi possono formarsi in qualunque punto dell'organismo e presentano quadri istologici quanto mai vari. Viene riferito un caso di amartoma della mano.

REFERENCES

1. Proc. Staff Meet. Mayo Clinic 24:587, 1949.
2. Albrecht, E.: Ueber Hamartome. Verhandl. d. deutsch. path. Gesellsch. 7:153-157, 1904.

There is a pride which incites a man to override his inferiors, while it does not hinder his crawling at the feet of those who are above him. It is a peculiarity this vice, which is based neither on personal merit nor virtue, but on riches, place, influence, and useless knowledge, that it renders a man equally apt to look with contempt upon persons who do not share with him those advantages, and to think too highly of those who are more largely endowed with them than himself.

—*La Bruyére*

# Hamartoma of the Lung

EMANUEL MARCUS, M.D., Ph.D.*, F.A.C.S., F.I.C.S.

CHICAGO, ILLINOIS

PULMONARY hamartoma has been called "an interesting and rare tumor."[1] It is almost always diagnosed postoperatively or post mortem. The reasons for the improbability of preoperative diagnosis are: first, the lesion does not produce a characteristic picture,[2] and second, most hamartomas are peripheral, not endobronchial, and therefore are asymptomatic. It is very likely that the tumor will be observed and described more frequently in the future than it has been in the past, judging by the literature, because of the following factors: (1) more frequent use of thoracic films in the diagnosis of diseases of the chest; (2) the popularity of chest film surveys; (3) the extended use of bronchoscopic and bronchographic technics, with biopsy, and (4) the modern practice of performing exploratory thoracotomy for the diagnosis and removal of so-called "coin" lesions, which the peripheral hamartomas resemble.

Pathologically hamartoma is a mixed tumor and was so classified by Womack and Graham,[3] although it was Albrecht[4] who originally used the term in 1904. Strictly, chondrohamartoma or hamartochondroma are better terms (Jaeger[5]). All elements of the bronchus, not alone the cartilage, are present in the growth; the proportion and arrangements of the components are bizarre. Islands of cartilage, surrounded by perichondrium, predominate; though the cartilage is usually hyaline, it may be fibrous or elastic, or calcified into bone. Grossly, it frequently feels like bone. Between the islands of cartilage may appear all the other tissues of the bronchus, including myxomatous connective tissue, epithelium (which may be ciliated) and smooth muscle elements.

Usually this lesion is classified as histologically benign; some pathologists, however, have described its malignant degeneration. Moreover, and it is believed that the case herein presented illustrates the point, such an histologically benign tumor may be clinically malignant because of its location near vital structures in the mediastinum and its strong tendency to compress these structures.

With regard to symptoms, a peripheral subpleural lesion causes pain. A lesion not near the pleura or a bronchus produce no symptoms. Endobronchial involvement is manifested by the symptoms of endobronchial irritation and obstruction from any cause—cough, pain, hemoptysis, dyspnea, and those disturbances consequent upon atelectasis with secondary infection. It is the endobronchial hamartoma that demands serious consideration in differential diagnosis, to distinguish it from bronchiogenic carcinoma and from tuberculosis.

## REPORT OF A CASE

A 24-year-old white man, a welder's assistant, was admitted to St. Margaret's Hospital, to the service of Dr. T. C. Tyrrell, on June 7, 1951. He complained of a "cigarette" cough of about two years' duration. During the past year he had coughed up some blood on numerous occasions; upon the first such episode he had been treated for pneumonia. He complained that during the past half-year of shortness of breath upon exertion. During all this time his sleep had not been interrupted; during the past few weeks, however, it had become necessary for him to sleep with the head considerably elevated in order to prevent paroxysms of cough.

The patient had lost 8 pounds (3.6 Kg.) in weight during the past year. The sputum pro-

*Assistant Professor of Surgery, The Chicago Medical School.

From the Department of Surgery, The Chicago Medical School, Chicago, and the Surgical Service of Dr. T. C. Tyrrell, St. Margaret Hospital, Hammond, Indiana.

Submitted for publication Jan. 12, 1954.

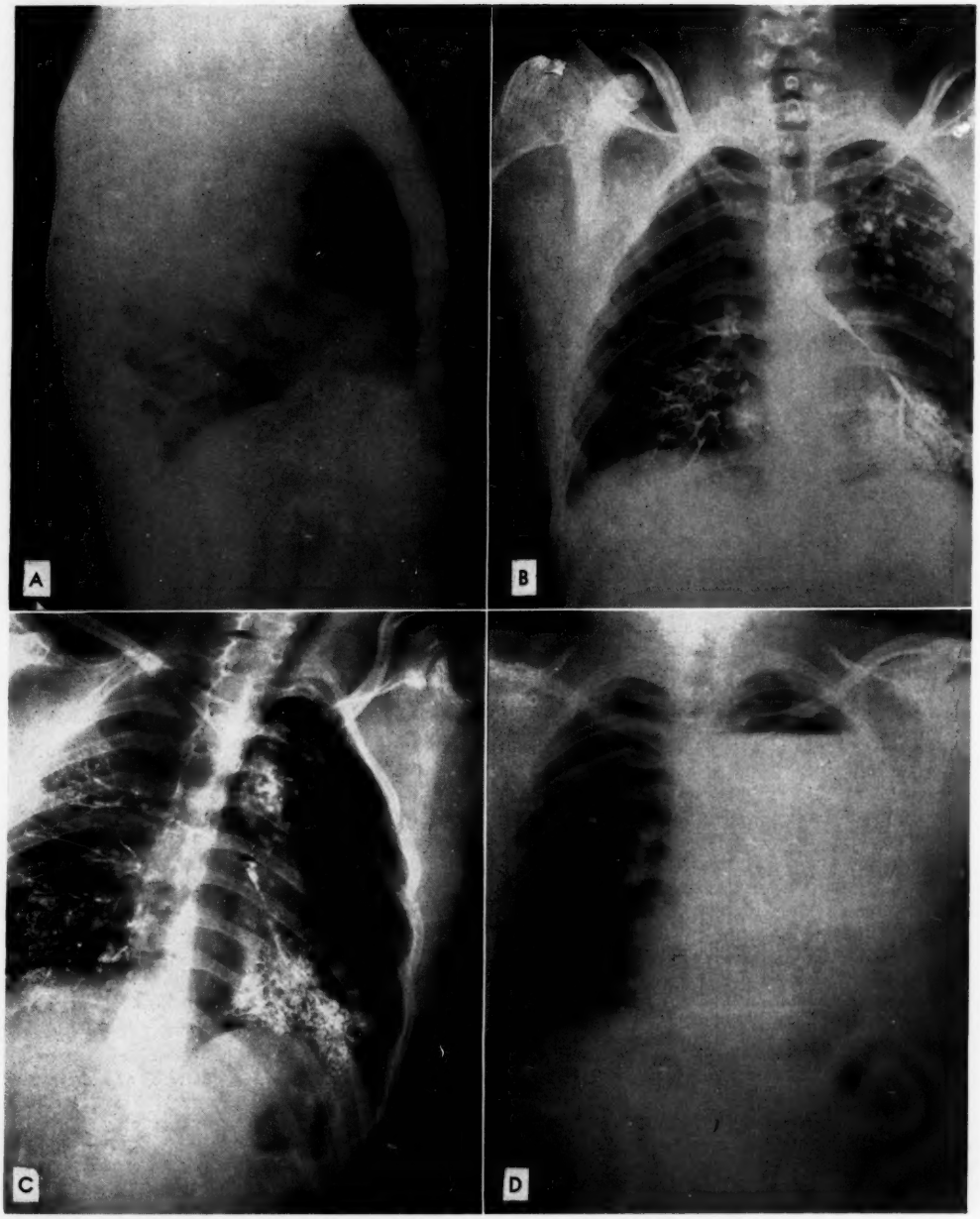



Fig. 1.—*A*, right lateral roentgenogram of the chest, showing left hilar and parahilar density. *B*, view showing constriction of left main stem bronchus. *C*, oblique view showing stricture of left main stem bronchus. *D*, post-pneumonectomy thoracic roentgenogram, anteroposterior view.

Fig. 2.—Field almost entirely composed of myxomatous connective tissue which stains light purple with hematoxylin and eosin. (*Photomicrograph taken by T. Scanlan, Chicago Medical School.*)

duced by the cough, when not bloody, looked like yellow mucus. The pain in the chest was dull and not severe, although it lasted several days at a time. There was no personal history of congenital heart disease, tuberculosis or asthma. The patient smoked about one package of cigarettes per day. He stated that he had worked under conditions where he inhaled rust dust and gasoline fumes. He had undergone no previous surgical treatment. Both parents and two siblings were living and well.

Physical examination revealed that the patient was not in distress. The temperature was 98 F., the pulse rate 80 and the respiratory rate 18. There were no distended veins in the neck; the thyroid was normal to palpation, and there was no cervical adenopathy. The blood pressure in millimeters of mercury was 122 systolic and 82 diastolic. The heart was normal to auscultation. There was a slight lag of the left hemithorax on deep inspiration; no abnormal breath sounds were heard. Examination of the abdomen and extremities revealed no patent pathologic change. Neurologic and ophthalmic examinations gave normal results. The value for hemoglobin was 13.9 Gm., or 86.9 per cent. There were 4,700,000 red blood cells and 7,000 leukocytes per hundred cubic centimeters, with 70 per cent polymorphonuclears, 1 per cent eosinophils and 29 per cent lymphocytes. There were no abnormalities in the urine. Roentgen film of the chest showed a hilar and parahilar density of the left lung, which appeared inflammatory. Repeated sputum examinations over a period of sixteen days revealed no acid-fast bacilli. Bronchoscopic investigation showed narrowing of the left main bronchus, with somewhat inflamed mucosa. Biopsy and exfoliative cytologic studies failed to show any evidence of malignant disease. Bronchographic study clearly delineated a marked narrowing of the left main bronchus, extending over the greater

Fig. 3.—Myxomatous collagen in upper half of slide, heavy infiltration of lymphocytes below it, and some alveoli in right lower corner. (*Photomicrograph taken by T. Scanlan, Chicago Medical School.*)

part of its length. Bronchoscopic examination was repeated, with the same results.

Unable to prove the presence of bronchiogenic carcinoma or tuberculosis, and yet unable to disprove the former, with positive evidence of compression of a considerable length of bronchus, it was decided to resort to exploratory thoracotomy for diagnosis and whatever therapy should seem indicated. Accordingly, under endotracheal anesthesia, the patient was subjected to exploratory thoracotomy on June 22. With the patient in the right lateral decubitus position, a left posterolateral incision was made and the sixth rib resected. Exploration revealed an extremely hard mass in the left hilus, which could not be separated from the lung tissue. A biopsy specimen of the mass was taken and biopsy performed by frozen section. Dr. Jean Pilot, pathologist, reported that the lesion appeared diffuse and myxomatous, and that the most likely diagnosis was hamartoma. Grossly, the lesion also seemed diffuse, spreading from the hilus in all directions; the actual periphery of the lung, however, felt normal. There were adhesions between the visceral and parietal layers of the pleura. Although the hilus seemed fixed and stony hard, it was decided that a penumonectomy should be attempted, because here was a lesion which might be histologically benign but which could easily kill the patient by virtue of its position surrounding vital blood vessels, and by virtue of repeated episodes of atelectasis with secondary infection of lung tissue. The total pneumonectomy was accomplished, but it was impossible to remove a small plaque of the stony hard mass in the hilus, which was attached to the pericardium and the bases of the aorta and the main pulmonary artery; accordingly, this plaque was allowed to remain. Also, the usual meticulous closure of

the bronchus was not possible for the same reason. It was closed, however satisfactorily. The chest was closed without drainage. The postoperative course was very smooth, and the patient was discharged on July 5.

*Pathologic Report.*—The specimen consisted of the left lung, in two portions. The upper lobe weighed 140 Gm. and appeared collapsed. A portion of hilus was missing. The visceral pleura was rough and shaggy in the lower half, owing to dense adhesions; the upper half appeared smooth and glistening. The apex presented no scars. There was no gross evidence of neoplasm. The lower lobe weighed 136 Gm.; a portion of the hilus was missing. Attached to the parenchyma at the site of the hilus were seen portions of shaggy grey tissue, extremely firm and presenting a fairly sharp outline from the remainder of the parenchyma. This tissue appeared grossly neoplastic but did not appear to be invasive. The remainder of the parenchyma contained air. The lower two-thirds of the visceral pleura was covered with adhesions, and the entire base was similarly rough and shaggy.

Microscopically, multiple sections through the hard tissue described as present in the hilus in the lung revealed areas consisting of dense bands of collagenous tissue interspersed with numerous nuclei that appeared to be those of fibroblasts and lymphocytes. There was a fairly sharp line of demarcation between this involved area and the lung parenchyma which revealed typical alveoli, several of which were filled with blood. In the zone between the dense fibrous tissue described and the lung parenchyma were numerous bronchioles and blood vessels, with surrounding large accumulations of lymphoid tissue. One area of dense fibrosis revealed an accumulation of a moderate amount of coal pigment. In one area there were accumulations of small dark-staining cells which were distinctly elongated and appeared endotheliomatous rather than lymphocytic. The nuclei throughout appeared regular and showed no evidence of any malignant change. Two other foci revealed a distinctly granulomatous picture; fibrous tissue infiltrated with numerous inflammatory cells, including plasma cells and an occasional polynuclear. In one area the accumulation of nuclei resembled smooth muscle fibers. The pathologic diagnosis was hamartoma.

*Follow-up Note.*—At the time of writing, three years after pneumonectomy, the patient is well. He is free of all respiratory symptoms and has regained his lost weight.

## SUMMARY AND CONCLUSIONS

A case of hamartoma of the lung is presented, in which the lesion was successfully treated by pneumonectomy.

Most hamartomas of the lung are small and peripheral. In the case here reported, it grossly involved the entire hilus and the great vessels of the mediastinum. It arose from the left main stem bronchus. This case exemplifies the fact that a lesion may be benign histologically and yet be clinically malignant by virtue of its position.

The search for and recognition of less common lesions of the thorax by all available diagnostic means is recommended.

## RÉSUMÉ ET CONCLUSIONS

L'auteur présente un cas d'hamartome dysembryoplasie, bronchiome polymorphe) du poumon, dans lequel la lésion fut traitée avec succès par une pneumonectomie. La plupart des hamartomes du poumon sont petits et situés à la périphérie. Dans le cas rapporté, l'hamartome entourait entièrement le hile et les gros vaisseaux du médiastin. Il provenait de la bronche principale gauche. Ce cas démontre qu'une lésion peut-être histologiquement bénigne mais cliniquement maligne en vertu de sa situation. L'auteur recommande donc de dépister les lésions rares du thorax par toutes les méthodes d'investigation connues.

## ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Es wird über einen Fall von Hamartom der Lunge berichtet, der mittels Lungenresektion erfolgreich behandelt wurde.

Die meisten Lungenhamartome haben geringe Ausmasse und sind peripher gelegen. Im vorliegenden Falle waren ungefähr die gesamte Lungenwurzel und die grossen Gefässe des Mediastinums einbezogen. Die Geschwulst ging vom linken Hauptbronchus aus. Der Fall zeigt, dass eine histologisch gutartige Erkrankung auf Grund ihrer anatomischen Lage im klinischen Sinne bösartig sein kann.

Es wird angeregt, mit allen zur Verfügung stehenden diagnostischen Hilfsmitteln auch nach selteneren Erkrankungen der Brusthöhle Umschau zu halten und eine Diagnose zu versuchen.


### CONCLUSIONI RIASSUNTIVE

Viene presentato un caso di amartoma del polmone, curato con la pneumonectomia. In genere qqueste affezioni sono piccole e periferiche, ma in questo caso si trattava di un grosso tumore che interessava tutto l'ilo e i grandi vasi del mediastino, a partenza dal bronco principale di sinistra. Esso era benigno istologicamente, ma maligno — come spesso avviene — in rapporto con la posizione. L'affezione è infrequente, ma è degna di essere studiata con ogni mezzo possibile.

### RESUMO E CONCLUSOES

É apresentado um caso de hemartôma do pulmão tratado com sucesso pela pneumectomia.

A maioria de tais tumôres se encontra localisada perifericamente e atinge pequeno desencolvimento, todavia, no caso aqui registrado, o desenvolvimento se verificou no hilo abrangendo ainda os grandes vasos do mediastino, provindo do bronquio principal esquerdo .

O caso evidencia que uma lesão pode sêr histologicamente benigna, e, clinicamente, maligna face a sua posição e desenvolvimento.

Recomenda o autôr um estudo cuidadoso e uma pesquiza detalhada das lesões do torace, para o que se deve lançar mão de todos os meios propedeuticos usuais visando a sua perfeita identificação.

### RESUMEN Y CONCLUSIONES

Se presenta un caso de hamartoma del pulmón en el cual dicha lesión se trató con éxito por medio de la pneumonectomía.

La mayoría de los hamartomas pulmonares son pequeños y periféricos. En el caso comunicado aquí, envolvía gruesamente todo el hilio y los grandes vasos del mediastino. Se originó del bronquio izquierdo principal. Este caso ilustra el hecho de que una lesión puede ser benigna histológicamente y sin embargo ser maligna en virtud de su localización.

Se recomienda la búsqueda y reconocimiento de las lesiones menos comunes del tórax por medio de todos los medios diagnósticos de que se dispone.


### REFERENCES


1. Effler, D. B., and Scheid, J. E.: Pulmonary Hamartoma: Report of Three Cases, Cleveland Clin. Quart. 18:6, 1951.
2. Whiteside, J. H.: Hamartoma of the Lung, Canad. M. A. J. 63:383, 1950.
3. Womack, N. A., and Graham, E. A.: Mixed Tumors of the Lung: So-Called Bronchial or Pulmonary Adenoma, Arch. Path. 26:165, 1938.
4. Albrecht, E.: Ueber Hamartome, Verhandl. d. Deutsche Path. Gesellsch. 7:153, 1904.
5. Jaeger, L.: Apropos de quelques de "Chondromas Pulmonaires." (Les hamartomes pulmonaires: hamartochondromes et hamarto-kystomes), Ann. d'Anat. Path. 12:811, 1935.
6. Thomas, M. R.: A Cystic Hamartoma of the Lung in a New-Born Infant, J. Path. and Bact. 61:599, 1949.
7. Simon, M. A., and Ballon, H. C.: An Unusual Hamartoma (So-Called Chondroma of the Lung), J. Thoracic. Surg. 16:379, 1947.
8. Lemon, W. E., and Good, C. A.: Hamartoma of the Lung; the Improbability of Preoperative Diagnosis, Radiology 55:692, 1950.
9. McGlumphy, C. B.: A Special Form of Chondroma of the Lung, J. Cancer Research 8:482, 1924.
10. McDonald, J. R.; Harrington, S. W., and Clagett, O. T.: Hamartoma (Often Called Chondroma) of the Lungs, J. Thoracic. Surg. 14:128, 1945.
11. Johnson, C. R.; Clagett, O. T., and Good, C. A.: Importance of Exploratory Thoracotomy in the Diagnosis of Certain Pulmonary Lesions, Surgery 25:218, 1949.
12. Bragg, E. A., and Levene, G.: Hamartoma of the Lung, Radiology 54:277, 1950.

# Release of Adduction Contracture of the Thumb

MICHAEL BURMAN, M.D.

NEW YORK CITY, NEW YORK

ADDUCTION contracture of the thumb occurs in three of the four groups of acquired hand disability, that is, the spastic, the arthritic and the traumatic. It is almost never associated with infantile paralysis or ulnar nerve palsy, but it is sometimes observed in cases of Erb's palsy. The thumb is held near the side of the index finger in the plane of the hand, and the movements of extrinsic abduction (abduction in the plane of the hand) and of opposition are limited. There is sometimes a comparable contracture in a plane a little forward of the plane of the hand, to which is joined opposition position of the thumb and intrinsic deformity of the thumb (pseudo-adduction contracture of the thumb).

Adductor dominance in time causes abductor weakness, the mild deformity of pollex valgus, and ulnar sesamoiditis, for the ulnar sesamoid bone of the thumb is placed in the tendon of insertion of the adductor muscles.

When the contracture resists correction by exercises, splinting (Littler and Tobin) or manual stretching, the operative release of the tight structures is indicated. The first dorsal interosseous muscle, a secondary adductor of the thumb, is stripped from the first metacarpal bone, and the combined tendons of insertion of the two adductor muscles cut. Section of the latter alone dones not fully overcome the contracture. Full passive spread of the thumb is the *sine qua non* for any operation to obtain active opposition or abduction of the thumb.

Release of the adductors is usually joined with other operative procedures done at the same operative session or later, for it is only one of several deformities needing correction.

From the Hospital for Joint Diseases.
Submitted for publication Jan. 8, 1954.

*Technic of Operation.*—The operation is done with the patient under general anesthesia, the pneumatic tourniquet being used to make the operative field bloodless. A longitudinal incision is made along the dorsoulnar border of the first metacarpal bone (Fig. 1*A*). Its proximal limit is the carpometacarpal joint of the thumb, which ordinarily is not explored. Its distal limit passes just beyond the metacarpophalangeal joint of the thumb. If adductor release is done coincidentally with fusion of the wrist, two separate incisions may be used, or one long incision that exposes both operative areas. After division of the subcutaneous tissues, the extensor pollicis longus is isolated and retracted ulnarly (Fig. 1*B*). Care is taken not to cut the slender dorsal digital nerves. The origin of the first dorsal interosseous muscle is stripped from the first metacarpal bone (Fig. 1*C*). The combined tendons of insertion of the adductor transversus and of the adductor obliquus pollicis are exposed in the distal part of the wound. (Fig. 1*D*). A curved Kelly clamp is passed beneath the conjoined tendon, and the tendon is cut on the spread blades of the clamp. Care should be taken not to injure the arteria princeps pollicis or its accompanying vein, which lie volarly to the conjoined tendon. The capsule of the carpometacarpal joint of the thumb is cut if there is still resistance to full passive abduction, especially its ulnar and volar corner, the radial vessels being retracted ulnarly. The subcutaneous tissues and skin are sutured and the thumb immobilized in full abduction with plaster. The pressure of gauze pads on the web of the thumb eliminates the dead space (Fig. 1*E*).

The operation is neatly anatomic and can be done in fifteen or twenty minutes. after three weeks, the plaster is removed

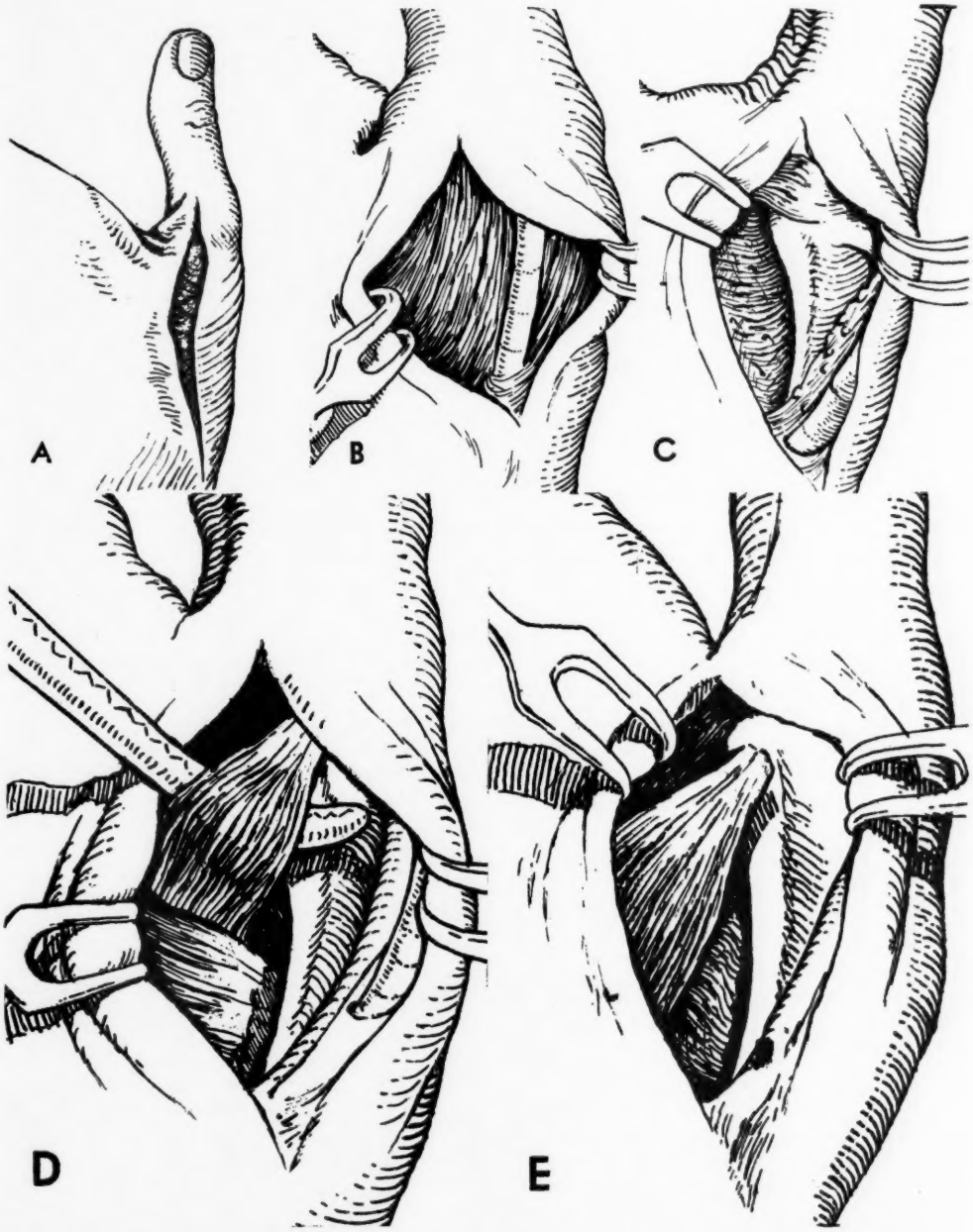



Fig. 1.—Operative technic. *A*, incision. *B*, isolation and ulnar retraction of extensor pollicis muscle. *C*, stripping of area of origin of first dorsal interosseous muscle from first metacarpal bone. *D*, combined exposure of tendons in distal part of wound. Curved Kelley clamps passed beneath conjoined tendon, which is then cut on spread blades of clamp. *E*, operative wound ready for suturing.

and physical therapy begun. Substitutionary adduction is achieved by the extensor pollicis longus and the occasional reattachment of the lengthened cut structures. Opposition is easier and the pinch of the finger stronger.

Alternative procedures are the manual stretching of the adducted thumb, which, if successful, obviates the need of operation, and subcutaneous tenotomy of the tendon of insertion of the adductor muscles.

A sequel of the operation may be loss of the balance of power between the adductor and thenar muscles, indicated by slight volar rotation of the thumb.

Five cases of section of the adductor muscles were previously reported, with emphasis on the correction of spastic adduction contracture of the thumb. These are not again presented except for the reproduction of a spastic hand with typical adduction contracture (Fig. 3). The operation has a wider application than its use in the limited field of spastic paralysis.

Adductor release was done in 6 hemiplegic patients, in a man with Erb's palsy and in 5 with injured hands. Of the last-mentioned, 3 had crush injuries, 1 a Volkmann's contracture and 1 median nerve palsy. Subcutaneous section of the adductors was done in this last case, but open release was later needed. Subcutaneous section was likewise done in a poliomyelitic thumb just before the Bunnell operation which restored opposition. Manipulation of the thumb was used twice successfully. Illustrative cases are given.

## REPORT OF CASES

CASE 1a (*adduction contracture of the thumb after diffuse injury of the hand; manual stretching of the thumb under anesthesia*).—The limitation of motion of the right osteoarthritic hand of a man 43 years old followed diffuse injury to the hand. (The spread of the right thumb, measured between the midpoints of the tip of the thumb and the index finger, was 4¾ inches, (11.9 cm.); that of the left, 6 inches (15.2 cm). The hand was manipulated, with the patient under general anesthesia, on April 21, 1947, to increase both the range of flexion of the fingers and the spread of the thumb. The finger tips could be flexed to ½ inch (1.2 cm.) from the palm and the thumb spread and opposed fully. Adhesions were heard breaking about the metacarpophalangeal joint of the index finger.

The spread of each thumb on Sept. 9, 1952, was 6¾ inches (17.1 cm.), and its opposition was full. The patient made a good fist.

CASE 1b.—An example of rapid mobilization of the thumb occurred in a man 44 years old, whose right hand was crushed on Aug. 6, 1952. The proximal phalanges of the middle, ring and little fingers were shattered, and in the middle and ring fingers the fragments were angulated volarly. The hand was rigid on September 8, and there was only a little motion of the fingers. The thumb was held to the side of the index finger. Its spread was less than half that of the normal left thumb, and opposition was allowed only to the middle finger

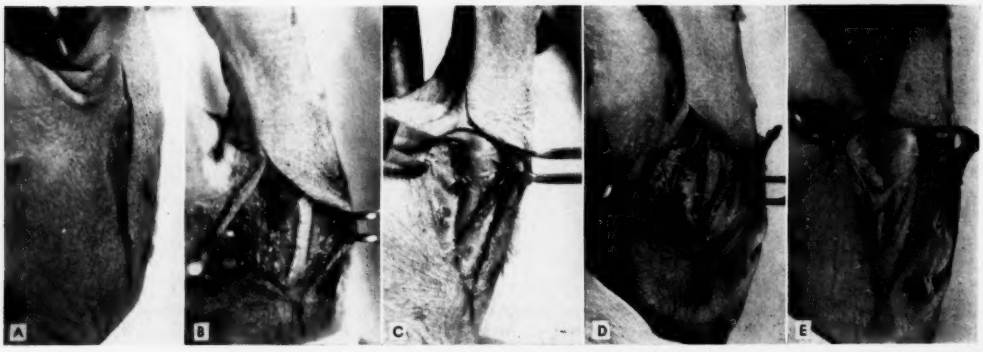



Fig. 2.—Technic of operation (see text and diagram, Figure 1).

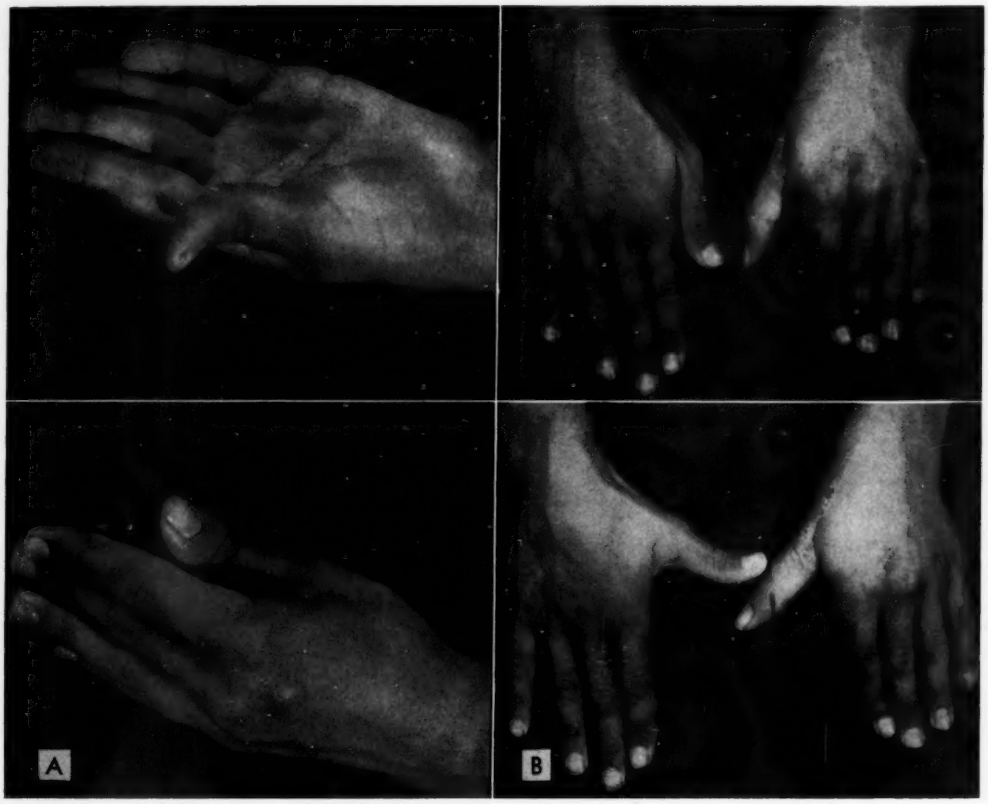



Fig. 3.—Spastic hand with typical adduction contracture. *A*, hand before operation; *B*, hand after operation.

(Fig. 4). With the patient under general anesthesia, the thumb and fingers were manipulated on September 11. The thumb was mobile actively and passively on September 23. The patient could spread his right thumb 5 inches (12.7 cm.) and oppose it to the little finger (Fig. 5). The spread of the left thumb was 6¼ inches (15.8 cm.). The same conditions were present on Dec. 2, 1953.

CASE 2 (*spastic adduction contracture of the right thumb; adductor release*).—A boy with right hemiplegia underwent this operation on July 12, 1943, when he was 5 years old. On Sept. 9, 1952, when he was 15 years old, the passive spread of the right thumb was 5¼ inches (13 cm.) and its active spread 4 inches (10 cm.). The active spread of the left thumb was 6¼ inches (17.1 cm.). Opposition of the thumb was easy and full. The thumb was rotated volarly a little by the pull of the thenar muscles, an expression of persistent imbalance between the adductor and thenar muscles. When the boy made a fist, he flexed and adducted his wrist, and sometimes he brought the thumb under the fingers (Fig. 6).

CASE 3 (*a similar operation in a similar situation, plus capsulotomy of the carpometacarpal joint of the thumb; operative correction of the extensor variant deformity of the index finger.*—A boy 15 years old has left hemiplegia. Transplantation of the flexor tendons of the wrist to the extensor tendons of the finger had been done in 1938, resulting in an extension deformity of the wrist. The adduction deformity of the thumb limited both its opposition and its spread (Fig. 7*A*). The adduction contracture was released on July 19, 1948. It was necessary to cut the ulnar side of the capsule of the carpometacarpal joint of the thumb both volarly and dorsally to achieve

Fig. 4 (Case 1b).—Hand of a man aged 44, almost immobilized by trauma (see text).

easy and full abduction.

The extensor variant (intrinsic plus) deformity of the index finger was corrected at the same time, since the hyperextension deformity of the proximal joint limited flexion of the finger.

The patient worked as a messenger boy on Sept. 9, 1952. He stated that he could hold large objects with the hand, such as a glass or a soda bottle. The passive spread of the two thumbs was equal. He could abduct the thumb actively and carry it to the ring finger. The index finger, held at a higher level than the other fingers, was flexed at all three joints. Sometimes the proximal joint hyperextended to reproduce the extensor variant deformity, but to a lesser degree than before the operation. He was well satisfied with the operative result (Fig. 7*B*).

CASE 4 (*spastic adduction contracture of the thumb; fusion of the wrist. Later section of the adductor muscles and transplantation of the extensor carpi ulnaris to obtain abduction of the thumb*).—A girl 13 years old had right hemiplegia, with the usual dominant deformities; pronation of the forearm, volar flexion of the wrist and adduction contracture of the thumb. Fusion of the wrist was done on March 5, 1945. On July 8 adductor release of the thumb was followed by intrathecal transplantation of the extensor carpi ulnaris to obtain active abduction of the thumb. The result of the operation was satisfactory in the follow-up period of one and one-half years. The thumb was kept out of the palm, and the girl could hold objects well. She hyperextended the metacarpophalangeal joint of the thumb when she abducted it. (This case was reported in the New York State Journal of Medicine of February 15, 1948.)

CASE 5 (*a similar case with a less happy result; development of the extrinsic deformity of the thumb*).—The patient, a woman, has right hemiplegia. Stripping of the right thenar muscles had been done on Jan. 29, 1936, to overcome the indrawing of the thumb. This is a passive operation; hence recurrence is likely and can be prevented only by an active operation that draws the thumb out of the palm. In this case recurrence did indeed take place, the thumb becoming again indrawn and adducted. The wrist was fused on March 8, 1948, and the origin of the flexor muscles of

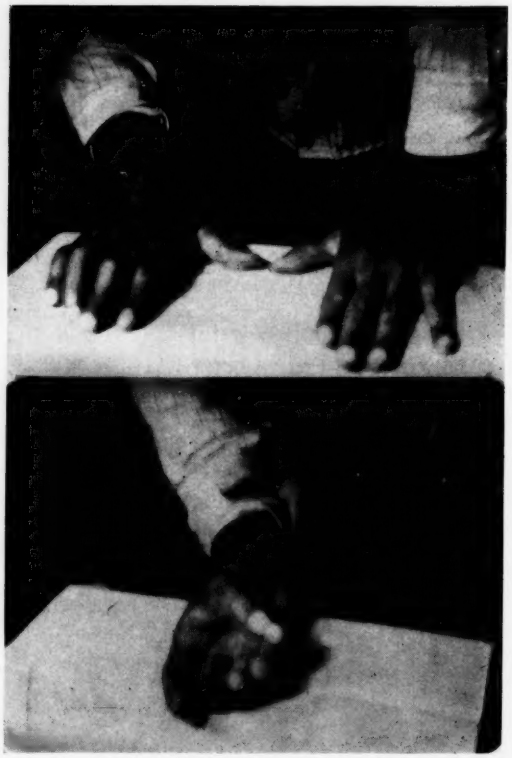


Fig. 5. (Case 1b).—Hand of same man after manipulation under anesthesia. An example of rapid and excellent mobilization (see text).

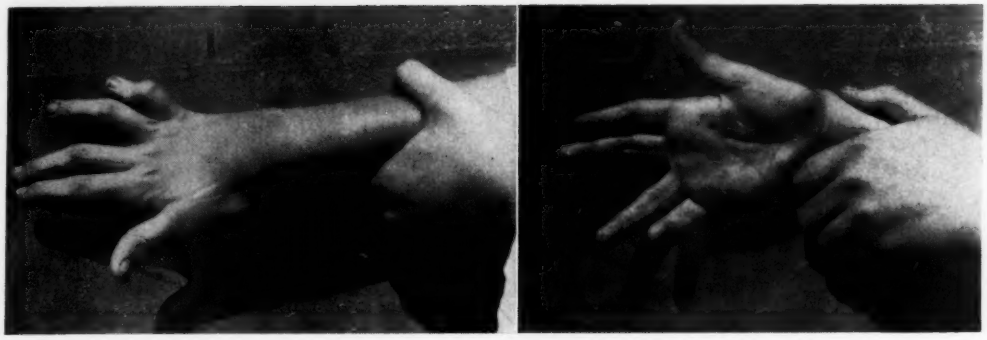


Fig. 6 (Case 2).—Hand of a boy aged 15 nine years after operation (see text).

the wrist and fingers stripped. On Aug. 31, 1949, when the patient was 23 years old, the adduction contracture of the thumb (Figure 8*A*) was overcome by the aforedescribed technic. The capsule of the carpometacarpal joint had to be cut, and only then could the thumb be abducted without hyperextension of the metacarpophalangeal joint. This operation was followed by intrathecal transplantation of the extensor carpi ulnaris to achieve active abduction of the thumb.

The result of operation as estimated after examination on Sept. 12, 1952, is not good, even though the patient felt that she had been helped. The passive spread of the thumb was full. The transplant had no power. The slightly opposed thumb showed the extrinsic deformity (Fig. 8*B*), the metacarpophalangeal joint being hyperextended 40 degrees and the interphalangeal joint flexed to 100 degrees. The patient opposed the thumb only to the index finger but could bring the thumb out of the hand. She could hold objects with fair power. This extrinsic deformity was first noted on Nov. 18, 1949.

CASE 6 (*positional adduction deformity of the thumb in tear of the median nerve; adductor section as one of several reconstructive procedures*.—A man, 51 years old on his first admission to the Hospital for Joint Diseases (on Sept. 19, 1946), cut the right median nerve and the flexor tendons of his fingers with a broken milk bottle in 1944. Immediate operative repair elsewhere was unsuccessful. Repeated operations were done to repair the flexor tendons.

Before the second operation it was seen that the thumb lay flat at the side of the hand. The passive spread of the right thumb measured 4½ inches (11.3 cm.), while that of the left thumb was 6¼ inches (17.1 cm.). On December 24, subcutaneous adductor tenotomy of the thumb was done, followed by a Bunnell operation to obtain opposition.

Recurrent adduction contracture seemed to be the prime reason for lack of opposition of the thumb. Therefore, on March 10, 1947, adductor release was done. In the section of the most volar part of the adductor insertion, a vein was cut which was the 'comes' (companion) vein of the arteria princeps pollicis. The Bunnell operation was revised, the insertion of the tendon graft previously passed through a drill channel in the first phalanx of the thumb being changed to allow better rotation of the thumb. Upon release of the tourniquet there was first blanching and then marked cyanosis of the thumb, with loss of turgor of its pulp. There was also a good deal of swelling about a button on the dorsoradial side of the thumb, used for the fixation of the tendon. The button was removed. The patient was given a series of stellate ganglion blocks, with gradual restoration of normal circulation.

On July 8 the active spread of the right thumb was 4⅝ inches (13.8 cm.) and its passive spread 5½ inches (13.9 cm). The spread of the normal left hand was 6¼ inches (17.1 cm.). The adductors had not reattached themselves to their normal point of insertion. The patient was able to bring the thumb to the little finger by a movement of pseudo-adduction but could not rotate the thumb, probably because of tightness of the capsule of the carpometacarpal joint of the thumb.

CASE 7 (*adduction contracture of the thumb as one of many deformities in crush injury of the hand and wrist*).—A man 49 years old, whom I saw on Oct. 14, 1949, at the request of Dr. Max Adelman, had crushed his right

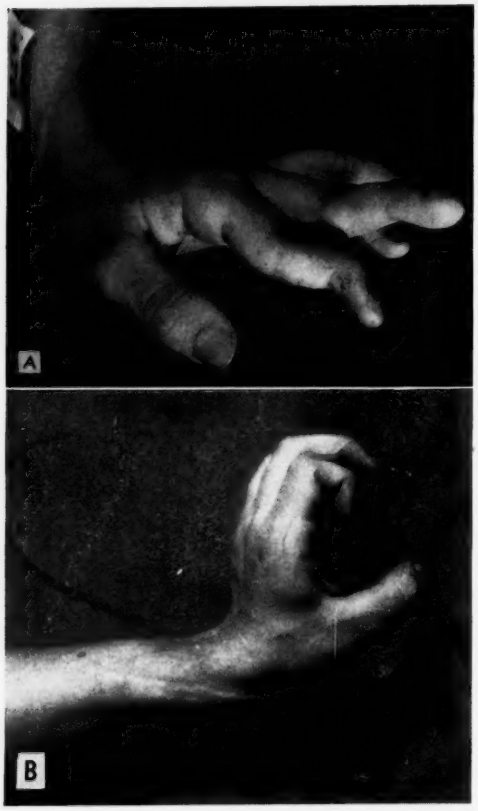



Fig. 7. (Case 3).—*A*, hand of another boy aged 15, with left hemiplegia (see text). *B*, hand 4 years after operation.

hand on July 20 under his overturned automobile. The wrist was adducted a little, but the motions were good. The neck of the ulna was obliquely broken, and the ulnar head showed volar and radial displacement, which limited supination of the forearm. The thumb, adducted by contracture, showed limitation of abduction and opposition. The mass of the adductor muscles showed a concave defect near their insertion. In addition, the thumb showed the extrinsic deformity, that is, the metacarpophalangeal joint was hyperextended and the interphalangeal joint flexed. There was also fixed clawing of the metacarpophalangeal joints of the index and middle fingers, restricting their flexion; and so, too, did flexion deformities of the interphalangeal joints of these fingers. The grip was weak and incomplete.

These several operations were carried out on November 19. The adductor and first dorsal interosseous muscles, torn away from the first metacarpal bone, were bound to it by scar tissue, especially near the point of insertion of the adductor. The fractured and foreshortened first metacarpal bone was short and broad and its surface irregular. This bone was stripped dorso-ulnarly of its soft tissues and the scarred adductor insertion cut. The capsule of the carpometacarpal joint of the thumb was cut. The thumb could now be fully spread and opposed.

Capsulotomy and resection of the thick collateral ligaments of the metacarpophalangeal joints of the index and middle fingers were next done, and these joints were manipulated into full flexion. The head and neck of the ulna were resected to restore full supination of the forearm.

The patient was greatly improved on Feb. 10, 1950, especially in the use of his thumb and the rotation of his forearm. The spread of the right thumb was 7 inches (17.7 cm.) and that of the left 6¼ inches (17.1 cm.). (Note the greater spread of the right thumb.) Passive opposition of the thumb was almost free. Active opposition made the thumb approach but not touch the middle finger. However, the patient still made a poor fist, because he could not flex the metacarpophalangeal joint of the index and middle fingers more than 10 degrees. The other joints of the fingers showed slight restriction of motion. Rotation of the forearm was free.

CASE 8 (*release of adduction contracture of the thumb and Z-plasty of the web in crushing injury of the hand*).—A Negro 33 years old crushed both hands in a power press machine on Dec. 12, 1949. He was left with a severe adduction contracture of each thumb and intrinsic extension deformities of the fingers, precluding flexion of the fingers. On April 27, 1953, the scarred tendon of insertion of the adductor muscles of the right thumb was resected and a Z-plasty of the skin of the web of the thumb performed. The extension deformities of the fingers were corrected by open section of the collateral extensor tendons of the index finger at the level of its proximal joint, manipulation of the middle and ring fingers and subcutaneous tenotomy of these tendons at the same level in the little finger.

There was satisfactory correction of the adduction contracture of the thumb on Oct. 28, 1953, the spread of the thumb being 5½

inches (6.9 cm.). The fingers still showed great restriction of motion, especially the index.

A similar procedure was used to correct the more severe adduction contracture of the left thumb on March 8, 1954. The adductor muscles were so extensively scarred that it was necessary to strip both the first and the second metacarpal bones. Contracture of the carpometacarpal joint of the thumb still limited the spread of the thumb and made its complete capsulotomy necessary. Full abduction was now achieved, but the base of the first metacarpal bone luxated dorsally. This luxation was apparently reduced. The web was lengthened by Z-plasty. A small full thickness skin graft covered a defect in the skin dorsally.

When the plaster was removed, the thumb was held in abduction and could not be adducted either passively or actively. A roentgenogram disclosed persistent dorsal luxation of the base of the first metacarpal bone. The contracture in abduction seemed due to the bony block of the greater multangular bone, *fixed* volarly in adduction. (It should be remembered that both the scaphoid and greater multangular bones move as the thumb moves.) The greater multangular bone was excised on May 6, 1954. The thumb could then be easily abducted and adducted.

## COMMENT

Adduction contracture of the thumb in the plane of the hand restricts its abduction and opposition. The release of contracture restores full passive movements of the thumb in abduction and opposition. In 1 case the passive spread of the operatively treated thumb was greater than the spread of the normal thumb. Since the operation is passive in that it only releases contracture, active abduction of the thumb, when it is lacking, must be achieved by a substitutionary tendon transplant, such as the intrathecal transfer of the extensor carpi ulnaris through the sheath of the abductor pollicis longus.

The extrinsic deformity of the thumb is not the direct sequel of abductor release. Rather, it follows the substitution of the abductor pollicis longus when the extensor pollicis longus is paralyzed. The synergy of abduction and extension is lost, and the effort to abduct expends itself at the metacarpophalangeal joint of the thumb. Synergy is recovered by the restoration of power to all three oblique muscles of the thumb, and this should prevent deformity.

The slight sequel of volar rotation of the thumb is clinically not important.

The follow-up periods of observation are generally adequate and indicate that adductor release accomplishes its purpose.

Fig. 8 (Case 5).—*A*, adduction contracture of the thumb in a woman aged 23 (see text). *B*, end result of operation, which was not satisfactory although the patient considers the condition improved.

SUMMARY

The author reports 13 more cases of adduction contracture of the thumb and outlines the technic for release of this contracture. Adduction contracture occurs chiefly in association with spastic, arthritic and traumatic conditions. The author's technic of surgical release is described and illustrated.

RESUMO

O autôr registra 13 casos de contratura em adducção do polegar, descrevendo a técnica para relaxamento de tal deformidade, que, segundo êle, ocorre associadamente a espasmos, artritismos ou traumatismos.

Por fim descreve sua propria técnica para cura cirúrgica, o que faz ilustradamente.

RÉSUMÉ

L'auteur rapporte 13 cas de contracture en adduction du pouce et décrit la technique employée pour remédier à cette contracture. La contracture en adduction est le plus souvent spastique, arthritique et traumatique. La technique chirurgicale de l'auteur est décrite avec figures à l'appui.

RIASSUNTO

L'autore riferisce su 13 casi di contrattura del pollice in aduzione e traccia il metodo per curarla. L'affezione compare di solito in associazione con malattie spastiche, artritiche o traumatiche. Viene descritta e illustrata una tecnica chirurgica personale.

ZUSAMMENFASSUNG

Der Verfasser berichtet über 13 Fälle von Adduktionskontrakturen des Daumens und beschreibt die Technik zur Behebung dieser Veränderung. Adduktionskontrakturen treten meist in Verbindung mit spastischen, arthritischen und traumatischen Erkrankungen auf. Der Verfasser beschreibt seine Operationsmethode an Hand von Illustrationen.

RESUMEN

El autor comunica 13 casos de contractura del pulgar en adducción y delinea la técnica para el alivio de esta contractura. La contractura en adducción ocurre asociada principalmente con padecimientos espásticos, artríticos y traumáticos. Se describe e ilustra la técnica quirúrgica del autor.

BIBLIOGRAPHY

Burman, M.: The Spastic Hand, J. Bone & Joint Surg. 20:133, 1938. Kinetic Disabilities of the Hand and Their Classification: A Study in the Balance and Imbalance of the Hand Muscles, Am. J. Surg. 61:167, 1943. Transplantation of the Extensor Carpi Ulnaris to Give Abduction to the Thumb, New York State J. Med. 48:383, 1948.

Howard, L. D. Jr.: Contracture of the Thumb Web, J. Bone & Joint Surg. 32A:267, 1950.

Littler, J. W., and Tobin, W. J.: Thumb Abduction Splint, J. Bone & Joint Surg. 30A:240, 1948.

It has been my fortune to love in general those men most who have thought most differently from me, on subjects wherein others pardon no discordance. I think I have no more right to be angry with a man, whose reason has followed up a process different from what mine has, and is satisfied with the result, than with one who has gone to Venice while I am at Siena, and who writes to me that he likes the place.

*Landor*

# Cineplasties and the Newer Technics

ERNST W. BERGMANN, M.D., D.A.B., F.I.C.S.

NEW YORK CITY, NEW YORK

JUDGING from the moderate headway made by cineplastic procedures in the United States, it would appear that I have chosen a topic of limited interest. It is well to remember, however, that the ever-increasing number of industrial and traffic accidents result in a proportionally increasing incidence of amputations. In fact they exceed by far the amputations of war injuries. During the four years of World War II, 18,000 amputations were done in the armed services, compared with 120,000 in civilian life. It makes for about 30,000 amputations per year, among which over 7,000 are amputations of the upper extremity. Figures like these justify, in fact demand, increased attention.

As is known, the idea underlying the principle of cinetization is to make use of certain muscles toward activating an artificial hand, muscles that otherwise remain idle and unused in a stump.

The initiative to transform an arm stump into something more useful originated with the Italians. During their hapless war with the Abyssinians in 1896, great numbers of Italians were made prisoners. It was a peculiar habit with the Abyssinians to cut their prisoners' hands off, one or both, and often on the slenderest provocation. Upon return to Italy these men posed a grave problem which stimulated Vanghetti, an internist, to devise a cineplastic procedure by forming tendon loops at the stump end, hoping that their movement could be utilized. It was his friend and surgeon Ceci who carried out the idea. The Italian method, as it is known, however, is not very effective, owing to the adhesions that are likely to develop, and the method has not many advocates.

New impetus was given to the idea of cinetization by Sauerbruch, who, during the first World War, developed his muscle tunnel procedure, which, as a matter of historical accuracy, was suggested to him by a Swiss engineer.

This procedure uses a skin tube which is formed from a pedicle flap by sewing it inside out, and passing this tube through a tunnel which is bored in the muscle belly, so that later the skin tube moves with the contracting muscle. It is this movement that activates an artificial hand with the aid of certain devices (Figs. 1 and 2).

The method, at first and for a long time thereafter, was given a cool reception here. It was only after the conclusion of the second World War that a commission under Col. Petersen studied the results of cineplastic procedures in Germany and came back convinced of their usefulness. By that time, to be sure, certain improvements had been developed, largely by a former associate of Sauerbruch's, Lebsche in Munich. Since then, and particularly during the Korean war, cineplastic operations have been done in great numbers, several hundred of them, by Col. August Spittler in Walter Reed Hospital. In fact, Col. Spittler has become an enthusiastic advocate of the method.

As to the changes in technic that have crystalized since the original publications by Sauerbruch, Nissen, myself and a few others, they are mainly as follows:

1. Canalization of the forearm muscles has been more or less given up, even in stumps having the necessary length as stipulated in previous papers.

2. As a rule, canalization is applied to the biceps alone. The idea of a double

Read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.

Submitted for publication Feb. 15, 1954.

motor, that is, the addition of a triceps tunnel for antagonistic action, has been given up, leaving this action to a spring in the terminal device.

3. The skin tube is made considerably wider.

4. The biceps tendon is severed from its distal attachment, so that it no longer flexes the elbow, a movement which is then done by the brachialis alone.

5. In short arm stumps the method can be successfully applied to the pectoralis muscle. This is in obvious contrast to what Sauerbruch, and later Nissen and myself, have said on sundry occasions. Lebsche's pectoralis tunnel has proved most valuable.

The indications for doing a cineplasty have not greatly changed. A man who has lost both hands is obviously the best candidate for such a procedure. Unlike the unilateral amputee, who can fall back on his one remaining natural hand, the bilateral amputee has no such choice. But the unilateral hand amputee too can greatly benefit by the operation. To be sure, aside from surgical considerations, a number of factors have to be carefully weighed beforehand — age, psychologic status, motivation and vocational plans. Only after all these points have been cleared satisfactorily can one embark on the procedure with confidence.

With the level of amputation near the

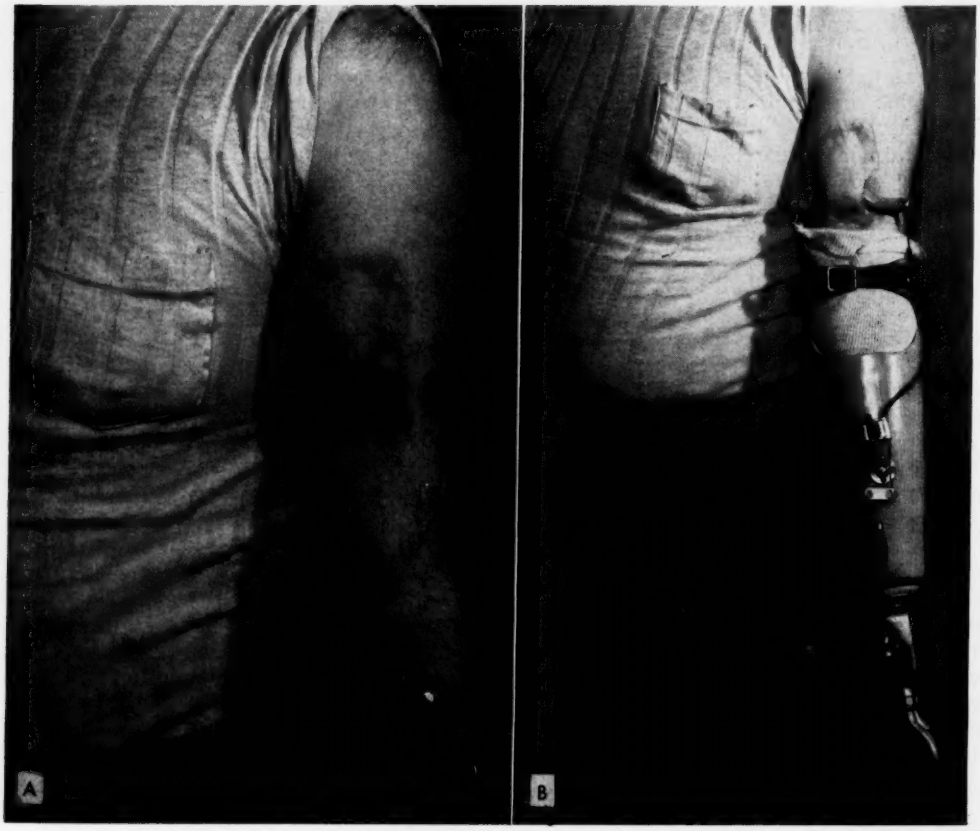



Fig. 1.—*A*, finished biceps canal. *B*, prosthesis attached. Terminal device is interchangeable, whether hook or hand.

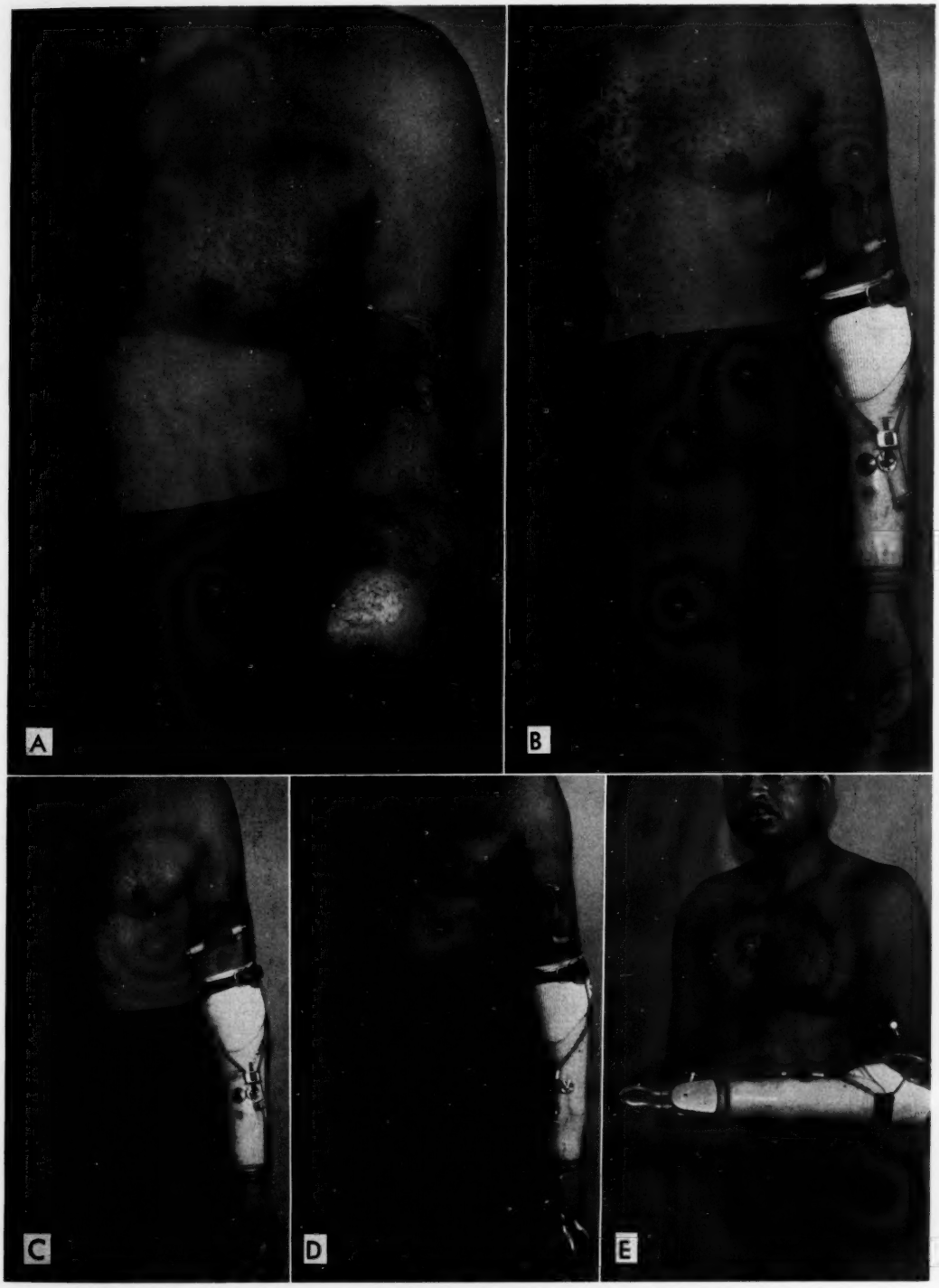



Fig. 2.—*A*, finished biceps canal. *B*, prosthesis attached with hand opened. *C*, hand closed. Note contraction of biceps. *D*, hand replaced by hook, opened. *E*, closing of hook, possible in any position of elbow.

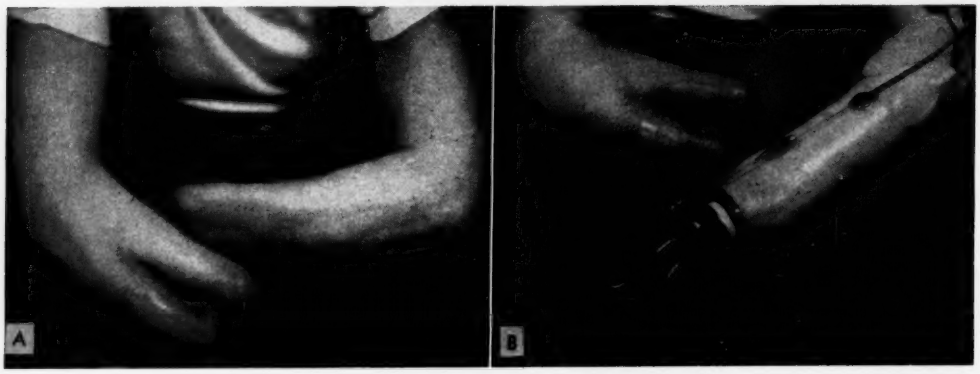



Fig. 3.—*A*, finished Krukenberg stump, right forearm. *B*, left forearm stump with conventional hook operated from opposite shoulder.

elbow or higher, the muscle canal type of operation is the only one available. But with disarticulation stumps at the wrist or amputations through the lower third of the forearm one might also consider doing a Krukenberg procedure. This is a type of cinetization based on an entirely different approch. By separating the radius and the ulna it aims at giving the radius independent movement away from and toward the ulna (Fig. 3).

If the muscle tunnel operation had to fight an uphill battle before it was accepted as a useful procedure, the Krukenberg technic has fared worse. For all practical intents and purposes it is still ignored. True, the operation is technically not simple. True, too, the lobster-claw appearance of the stump is an ugly sight, but from an esthetic point of view this applies to all stumps. Nevertheless the Krukenberg arm has certain advantages. It has sensation and does not require a prosthesis. These two factors are of prime importance in a certain type of injury; quite a number of persons have lost both hands *and* their eyesight because of land mines or other explosive accidents.

Naturally, for a blind man, sensation is everything. By the same token he has little use for an artificial hand, so that in his case supplying a Krukenberg arm is the procedure of choice. Without going into too much technical detail, it may be pointed out that the flexor and extensor tendons of the forearm are rearranged into an ulnar and a radial group, but actually there are only two tendons, which are indispensable and have to be identified: the brachioradialis, which draws the radius away from the ulna, and the pronator teres, which acts antagonistically. Implicitly the minimum length of the stump feasible for a Krukenberg arm is determined by the intact attachment of the pronator teres at about the middle of the radius. Shorter stumps are not suited to the procedure. The other muscles that help in the scissor action of the separated forearm limbs, namely, the biceps tendon on the radial side and the brachialis on the ulnar one, do not come into view at all, since they remain undisturbed and unexposed in the upper part of the forearm. Sectioning of the interosseus ligament is done close to the ulna in order not to interfere with the neurovascular bundle. With this ligament out of the way, one can easily spread the two bones. At the stump end the bones should be 4 to 5 inches (10 to 12.5 cm.) apart, when fully spread.

The main difficulty lies in the covering of the two limbs with skin. There is not enough of the original forearm skin to cover both prongs. With the incisions carefully planned, it is possible to cover the radial limb entirely with the original skin. The ulnar limb needs a skin plasty

for the raw inner surface that exists after the two bones are separated. The orthodox method, which Krukenberg himself applied, uses a pedicle flap from the abdomen. This is a cumbersome procedure and has deterred some surgeons from doing the operation at all. Free split thickness grafts have been used with some measure of success, but their disadvantage is twofold: it provides only for a thin layer of epithelium, which, being subjected to pressure on closure of the prongs, may easily break down. Second, it lacks sensation.

To obviate both these shortcomings I have devised a modification of my own, particularly applicable to disarticulation stumps at the wrist. Instead of doing a formal reamputation to rid the stump of its bulging bone ends, I shorten only the ends of the bone and the tendons, and the whole redundant skin is left in place. With this empty bag of skin one can cover the end of the ulna as well as most of its raw inner surface. Thus only a small area at the base of the scissors remains to be covered by a free graft.

In this fashion I treated, not long ago, a middle-aged man who was blinded and lost both hands in a mine explosion. A highly satisfactory result was obtained, in that the radius was entirely covered with original skin, keeping sensation intact, while the extra skin gained by the shortening of the bone was reflected toward the ulna to cover the distal half of its raw surface. Within this area also, sensation soon returned.

SUMMARY

The author presents a broad outline of the cinetization and its recent technical improvements. The principle underlying this method is the use of certain muscles toward activation of an artificial hand, muscles which otherwise remain idle and unused in the amputation stumps. Originating in Italy, the technic at first aroused no great enthusiasm in the United States but is now recognized as well worth the surgeon's consideration.

RÉSUMÉ

Les auteurs présentent dans les grandes lignes la cinématisation et ses récents progrès techniques. Le principe fondamental de cette méthode est l'emploi de certains muscles qui activent une main artificielle. Ces muscles resteraient inutilisés sans cette technique. Créée en Italie, la technique ne rencontra tout d'abord qu'un enthousiasme restreint aux Etats-Unis, mais maintenant les chirurgiens reconnaissent sa très grande valeur.

RESUMEN

Los autores presentan a grandes razgos la quinetización y su mejoramientos técnicos recientes. El principio en el cual esta basado este método, es el uso de ciertos músculos hacia la activación de una mano artificial, músculos que de otra manera permanecerían inactivos y sin uso en el muñón de amputación. Originaria de Italia, al principio esta técnica no despertó entusiasmo en los Estados Unidos. Sin embargo, actualemente se reconoce que bien vale la pena de la consideración del cirujano.

RIASSUNTO

Viene tracciata brevemente la storia della cinematizzazione e delle sue conquiste. Essa consiste nella utilizzazione di certi muscoli per muovere le mani artificiali, muscoli che altrimenti sarebbero inutilizzati. Nata in Italia, la tecnica è stata dapprima poco ben accettata negli Stati Uniti, mao ra ha trovato il pieno riconoscimento da parte dei chirurghi.

ZUSAMMENFASSUNG

Der Autor gibt einen weit gefassten Überblick über die Kinetisierung und ihre neuesten technischen Verbesserungen. Die Methode beruht auf dem Prinzip, gewisse Muskeln, die sonst müssig und unbenützt im Amputationsstumpf liegen bleiben, zur Aktivierung einer Handprothese zu verwenden. Das Verfahren, das

ursprünglich aus Italien kommt, fand in den Vereinigten Staaten anfänglich keine grosse Begeisterung, hat sich jetzt aber Anerkennung errungen und verdient durchaus die Aufmerksamkeit der Chirurgen.

RESUMO

O autôr apresenta largos comentarios acêrca da cinetisação e sôbre os seas recentes progressos de ordem têcnica.

O principio dêsse metodo vem a sêr o emprego de certos musculos na ativação de uma mão artificial. Originada na Italia, a técnia de inicio não foi recebida com grande entusiasmo nos Estados Unidos, porém, presentemente, está merecendo uma melhor atenção por parte dos cirurgiões locais.

REFERENCES

1. Alldredge, R. H.: The Cineplastic Method in Upper Extremity Amputation, J. Bone & Joint Surg. **30**:359-373, 1948.

2. Bergmann, E.: Principles of Cineplastic Operations, J. Internat. Coll. Surgeons **9**:99-103, 1946.

3. Nissen, R., and Bergmann, E.: Cineplastic Operations on Stumps of the Upper Extremity. New York: Grune & Stratton, 1942.

4. Spittler A. W. and Rosen, I. E.: Cineplastic Muscle Motors for Prosthesis of Arm Amputees, J. Bone & Joint Surg. **33A**:601-611, 1951.

For further references, see Nissen and Bergmann.[3]

Men born eloquent sometimes touch high matters in a manner so terse and so perspicuous that most persons would never think there was depth in their talk. Heavy persons and sophists do not recognize philosophy when eloquence brings it within every man's reach and dares to present truth with bold and spirited strokes. Shallow and frivolous in their judgment is that majesty of speech which carries along with it the proof of great thoughts. They are for definitions and disputations, for particulars and regular arguments.

Most great characters in history have been the most eloquent men of their time. The founders of the noblest creeds, the leaders of sects and factions, those who in every age have had most influence upon the minds of nations, owe the best part of their triumphs only to the quick and native eloquence of their hearts. It does not appear that they studied poetry with so much success, and that is because poetry hardly allows of a second occupation; the practice of so noble and so difficult an art can rarely be combined with the stress of affairs and the tempestuous business of life; whereas eloquence has a place everywhere, that owes most of its fascination to that conciliatory and diplomatic spirit which makes statesmen and administrators and the like.

—*Vauvenargues*

# Congenital Skin Defects

## Report of Three Cases

JAMES BUFORD JOHNSON, M.D., F.I.C.S.

BEVERLY HILLS, CALIFORNIA

ALTHOUGH the skin is commonly subject to a variety of minor aberrations, localized defects recorded at birth are relatively rare. In a large percentage of the cases reported the defects have been in the scalp and in or near the midline. In 1930, Terruhn[1] collected 76 cases of scalp defects as opposed to a total of 29 defects elsewhere on the body. There are undoubtedly a great number of minor defects that have not found their way into the literature, as well as others that have been reported under diffierent categories.

Morphologically, skin defects may be divided into two types; one is circular and sharply demarcated or punched out, the other elongated and stellate. In the scalp the elongated defects are likely to be more extensive and are often situated over one of the suture lines of the skull. On the trunk and extremities the defects may be very extensive and are often multiple. In the multiple defects there is a strong tendency toward bilaterality and symmetry. Occasionally the defect may present a raw, granulating surface, but usually it is covered by a thin, glistening membrane, which is more or less translucent. Beneath this membrane large blood channels may be seen to run parallel to the surface, with very few or no ramifications. After birth this membrane shows a marked tendency to dry out and become necrotic, with subsequent hemorrhage from the large vascular channels. Fatal hemorrhage is particularly common with scalp defects situated over the superior sagittal sinus. Another gross characteristic of these defects is the tendency for the normal skin bordering the defects to show hypertrophy. Skin defects may occur in conjunction with a variety of other congenital deformities but often occur alone.

The histologic picture varies somewhat in relation to the depth of the structures involved. In the usual case the dermis and subdermal adipose tissue are primarily affected, but occasionally deeper tissues and even bone may be included. The hair follicles, sweat glands, and sebaceous glands are entirely absent. The dermis and subjacent adipose tissue are scanty. The membrane is composed of thin, flat cells of one or more layers with sparse granulations beneath.

Although family histories are not available in many of the cases reported, it is interesting to note from those presented that congenital defects are most common in the child born of the first pregnancy. Those occurring in children born later have often been preceded by a series of abortions, miscarriages and premature births. In some instances identical or similar defects occur in more than one member of the family.

In 1767, Cordon[2] reported on 3 patients of the same parents with identical skin defects. Of 6 children born to these parents the first 2 and the fourth were entirely normal and healthy. The third, although well-formed otherwise, was devoid of skin from the knees to the toes and from the wrists to the ends of the fingers. The fifth and sixth were born devoid of skin in exactly the same manner as the third. In all 3 instances the children would not nurse; the raw areas suppurated for two or three days, and the child died on the fourth or fifth day.

In 1826, Campbell[3] reported similar

Submitted for publication June 21, 1953.

scalp defects in 2 members of the same family. The first child died on the eighth day, of massive hemorrhage, and the second at the age of 8 months, of chronic hydrocephalus. Others who have reported similar defects and deformities in the same family were Burger, Graff, and Greig.[4]

*Epidermolysis Bullosa.*—In 1934, Herlitz[5] described a new lethal form of epidermolysis bullosa usually accompanied by extensive skin defects. He termed it "epidermolysis bullosa herediteria letalis." He collected 22 cases, of which 8 were his own. The defects in this series showed a predillection for the extremities and occasionally the trunk. This new form differed from the simple and dystrophic form in that early death always ensued. In no case was the duration more than eight and one-half months, and usually death occurred before the third month. Herlitz's 8 patients were confined to three families, 4 in one and 2 in each of the others. There was no history of such defects in any of these families. The Nikolsky phenomenon (rubbing off skin in the bath) was present, but is was not possible to produce vesication by rubbing, pinching or bandaging. Marked dystrophy and deformity of the nails were observed, and sometimes the lesions progressed to involve skeletal atrophy of the terminal phalanges. Histologically there was degeneration of elastic tissue; the skin was thinner than normal, and the sweat glands and hair follicles were rudimentary or absent.

Davidson,[6] in 1940, described a similar case, in which a defect involved the wrist and dorsum of the left hand. Progressive bullae formed on the body and in the mouth, many of them becoming confluent. The child lost weight steadily in spite of adequate intake and died on the twenty-ninth day.

The occurrence of defects in conjunction with epidermolysis bullosa is not limited to the lethal form of that disease. They are relatively common with the dystrophic form. My own Case 2 falls into this category. It is generally acknowledged that all these defects are preceded by bullae, but whether a different process is at work in their association with epidermolysis bullosa is not known. In these cases superimposed infection certainly contributes to the pathologic change observed on microscopic examination, and it is difficult to state how much of the degenerative process was present in the original clean lesion. There is a great similarity between defects associated with epidermolysis bullosa and those that occur without other evidence of disease. The scalp defects seem to extend into the deeper tissues more often, but it is possible that reports of defects of the extremities have included only superficial ones that are rather large. All medical men have seen the so-called "congenital bands" completely encircling extremities and digits, and these are undoubtedly of the same origin. The intrauterine amputations so ably discussed by Streeter[7] in 1930 could conceivably have been preceded by circumferential defects involving deeper structures as well as the skin.

In an effort to determine at what developmental stage these defects occur, Hebra,[8] in 1881, examined sections of skin from a series of embryos. He concluded that the malformation began in the early stages but that development of the different tissues was not completely stopped thereby. The progress in development continued to such an extent that at birth the condition in the skin paralleled that seen in the fifth or sixth month of fetal life. Because of the lack of adipose tissue and the decreased density of the connective tissue, Hebra was led to suppose that an atrophic process was also involved which led to a less dense arrangement of the connective tissue. This in turn led to the formation of fissures in the cutis, which in time became filled with a serous fluid. He further noted that during the fifth and sixth months of fetal life the blood vessels in the cutis consist of large, thick trunks running parallel to the surface, with very few ramifications. Only with the further increase of these vessel branches did the development of the cutis approach that of

the mature child. The papillae were observed not to be fully developed until the ramifications of the vessels had entered them, and the ducts of the sudariparous glands failed to shown their multiple windings until the branches were in immediate proximity.

The etiologic factors involved in the production of skin defects, as well as other congenital deformities, are open to much speculation. The mother of Cordon's patients[2] attributed the defects to a wound on a sow's breast, which she had dressed every day during her third pregnancy, and Cordon could offer no better explanation. Prenatal influence soon gave way to trauma as an etiologic factor. This trauma was incurred from uterine polyps, pelvic exostoses, abnormal presentations, prenatal injury to the mother and, in 1 instance, contact with the fingernail of the nurse. In earlier reports the doctor or midwife was often blamed for the defect.

Hoffman,[9] in 1885, was the first to attribute the defects to amniotic adhesions. Kehrer[10] accepted this theory as the only possible explanation and expressed the opinion that, owing to inflammatory changes which he termed amniitis, adhesions were formed between the amnion and the embryo. Owing to fetal movements, the strong bands would pull away the portion of skin where it was attached. He was not able to demonstrate the bands and concluded that they had subsequently disappeared. Oing[11] and Terruhn[1] also attributed the defects to amniotic adhesions, the latter claiming to have demonstrated the bands in 1 instance.

The amniotic theory has been discarded, and it now seems evident that some arrest of development is involved. In some instances the presence of defects in siblings would indicate the possibility of some inherent, perhaps hereditary factor. Certainly the symmetry that often characterizes the multiple defects cannot be explained by any external factor.

The existence of a series of embryologic relations called "inductions" has been firmly established by experimental embryologists. The "organizer" of these inductions is the archenteric roof. From the archenteric roof an influence passes into the overlying ectoderm which renders it capable of forming nervous tissue. From here a step-by-step series of inductions takes place, involving most of the organs of the body. The mesoderm and entoderm react to a lesser degree than does the ectoderm. Direct contact between the cells and the inductor is necessary for the transmission of the influence, and anything that occurs to interfere with this relation will alter the development of specific organs.

Fig. 1 (Case 1).—Defect of left foot, which cicatrized itself.

Hebra[8] reasoned that the sparsity of connective tissue fibers gave rise to the formation of fissures in the cutis, which subsequently became filled with serous fluid. Ingalls[12] demonstrated in a series of fetuses the presence of subcutaneous blisters, which he considered precursors of skin defects. These blisters occurred at various levels in the skin.

If one assumes that serous fluid escapes into the dermis and forms a subcutaneous blister, is it not reasonable to suppose that some interference with the induction mechanism would take place, possibly from lack of contact of the cells with the inductor? One would still have to explain an earlier interference that caused the sparsity of connective fibers and fat. This may or may not bear some relation to the lack of ramification of the vessels or nerves, which also might be concerned with some stage of the induction mechanism.

Small defects will usually cicatrize themselves in a short time. Larger defects become an immediate surgical problem. In the scalp, large defects are subject to massive hemorrhage and sometimes meningitis when the covering membrane begins to become necrotic. The overall mortality rate for the reported cases is about 20 per cent, and only 1 case of closure is recorded in the literature. Hemorrhage in the extremities is not so dangerous, but adequate coverage must be accomplished as early as possible to prevent constant loss of tissue fluids.

In the scalp, closure is best accomplished by rotation flaps when possible. Larger defects of the trunk or extremities are usually so extensive as to require resurfacing with split skin grafts. Any remains of the membrane should be removed down to clean tissue prior to coverage by either method.

Ingalls[12] drew a marked contrast between defects in the scalp and those elsewhere in the body. In his opinion, the defects are of no practical significance unless they are on the scalp. Defects of the trunk or extremities "do not show the secondary complications of hemorrhage or infection and consequent effect upon mortality; their significance is largely cosmetic."

I have previously stated that the danger from fatal hemorrhage is greater with scalp defects. I should like to reiterate, however, that the tendency of the covering membrane to become necrotic is not restricted to scalp defects. Surgeons are aware of the danger of large open wounds anywhere on the body, both from the standpoint of sepsis and from that of the loss of body fluids. This danger is particularly acute in infants. Referring to the first 3 cases I was able to find in the literature, I noted that Cordon said defects on the upper and lower extremities: "In all 3 instances the children would not nurse, the raw areas suppurated for two or three days and they died the fourth or fifth day."

If the membrane remains intact and affords a good covering, no surgical intervention will be necessary. If the defect is large and the membrane becomes necrotic, however, it is incumbent upon the surgeon to provide proper coverage as early as the general condition of the patient permits.

## REPORT OF CASES

CASE 1.—A defect on the lateral surface of the left foot, measuring 2 by 1½ inches (5 by 3.7 cm.) was observed in a boy 7 years old. The defect was cicatrized and covered by a layer of scar skin, which was causing the patient no difficulty. There was no family history of similar defects. The patient was the full-term child of a first pregnancy.

CASE 2.—A full-thickness skin defect involving the entire dorsum of the left foot and completely encircling the left ankle was observed in a newborn child. Continuous wet dressings were applied to the area in an effort to prevent drying out of the membrane. In spite of this, the membrane showed signs of necrosis on the third day. It was decided that a split graft would provide a satisfactory surface coverage and prevent further loss of body fluids. On the fifth day the area was covered with a graft from the upper part of the abdomen and a successful "take" obtained. On the first postoperative day bullae were noted on the mucous membrane of the mouth and subsequently on other areas of the body from slight trauma. A diagnosis of epidermolysis bullosa was made. Skin sections indicated that the diagnosis was correct. The involvement was correct. The involvement of nails and sanguinous material in the bullae indicated that either the dystrophic or the lethal form

Fig. 2 (Case 2).—*A*, *B* and *C*, defect of left foot and ankle, treated by grafting. *D*, condition one year after skin graft.

was present. A guarded prognosis was given because of the lack of distinguishing characteristics between the two types.

The skin graft was well healed within two weeks, but the donor site was beset with complications and required several months to heal. Bullae developed beneath the dressing from time to time, owing to slight trauma, and as soon as one spot healed, another bulla would form elsewhere. Under open treatment the donor site finally healed, but an occasional bulla appeared subsequently without relation to trauma.

The boy was the full-term child of a first pregnancy. The labor had been normal and spontaneous, and the family history was noncontributory. The mother had a lightly pigmented spot covering almost the entire left cheek. This child is now 20 months of age and continues to do well. There has been no difficulty in weight bearing on the skin graft, and the general condition is excellent. Bullae formation is becoming increasingly rare.

CASE 3.—A large full-thickness skin and subcutaneous tissue defect involved the entire right cheek and the right side of the upper lip in a newborn child. There were also defects involving the left middle and right index fingers, distal to the proximal interphalangeal joints. The family history was negatively irrelevant and the pregnancy (a first one) uneventful.

Fig. 3 (Case 3).—Defect of right cheek, with thicker membrane that showed no tendency to become necrotic.

Two factors are of interest in this case. One is the involvement of the three middle branches of the facial nerve, and the other is the type of membrane covering the defect. Whereas in Case 2 the membrane was thin and glistening and the granulations could be seen beneath, this membrane appeared thicker, less glistening and less transparent. In contrast to the membrane in Case 2, it showed no tendency to necrosis and has remained intact for six months. Microscopically the two membranes appear identical except for thickness.

Emphasis should be laid on the fact that the membrane in Case 3, which was also composed of primitive flat cells, was somewhat thicker than that in Case 2. It was not so translucent, did not glisten so highly and showed no tendency to necrosis. The edges of the defect were not so sharply demarcated. The recent work of Douglas in utilizing amnion grafts in man, with excellent "takes," gives rise to the question whether the raw surface of a skin defect might not become the automatic recipient of a graft from the amnion *in utero*.

SUMMARY

Three cases of congenital skin defects are reported. In 2 of these the defects were on the lower portion of the left extremity in male children of primiparous mothers. In the third it involved the greater part of the right cheek, as well as one finger of each hand. One defect on the lower part of the left extremity was associated with the dystrophic type of epidermolysis bullosa. For large defects the mortality rate is very high. When the covering membrane shows signs of necrosis, it is wise to cover the defect either with neighboring flaps (when possible) or with split grafts.

RÉSUMÉ

L'auteur décrit trois cas de défects cutanés congénitaux. Dans deux de ces cas

qui étaient deux jeunes garçons de mère primipare, l'anomalie cutanée siégeait au niveau de la partie inférieure de l'extrêmité gauche. Dans le troisième cas, elle se localisait au niveau de la joue droite ainsi qu'a un doigt de chaque main. Un de ces défects, situé à la partie inférieure de l'extrêmité gauche, était associé à une épidermolyse bulleuse du type dystrophique. Lorsqu'il s'agit de défects plus importants, le taux de mortalité est très élevé. Quand la membrane qui recouvre le défect présente des signes de nécrose, il est prudent de le recouvrir au moyen de greffes par glissement ou par des greffes de Thiersch.

ZUSAMMENFASSUNG

Es wird über drei Fälle von angeborenen Hautdefekten berichtet. In zwei Fällen handelte es sich um Defekte der linken unteren Extremität bei Söhnen Erstgebärender. Im dritten Fall waren der grössere Teil der rechten Wange und ein Finger an jeder Hand betroffen. Der Defekt im unteren Abschnitt der linken Extremität ging mit einer bullösen Epidermolyse des dystrophischen Typs einher. Bei umfangreichen Defekten ist die Sterblichkeit sehr gross. Wenn die oberflächliche Membran Zeichen von Nekrose aufweist, ist es ratsam, den Defekt wenn möglich mit angrenzenden Hautlappen oder aber mit einem gespaltenen Transplantat zu decken.

RESUMEN

Se comunican tres casos de defectos congénitos de la piel. En 2 de estos, los defectos fueron de la porción inferior de la extremidad izquierda en niño de madre primípara. En el tercero se encontraba afectada la mayor parte de la mejilla derecha así como un dedo de cada mano. Un defecto de la parte inferior de la extremidad izquierda estaba asociado con el tipo distrófico de Epidermolisis bulosa. Para defectos grandes el grado de mortalidad es muy alto. Cuando la membrana muestra signos de necrosis, es sabio cubrir el defecto ya sea con colgajos vecinos (cuando es posible) ó con injertos separados.

RIASSUNTO

Descrizione di tre casi di mancanze cutanee congenite. In 2 il difetto interessava l'estremità dell'arto sinistro in maschi di madre primipara, nel terzo erainteressata la maggior parte della guancia destra e 2 dita. Uno dei casi presentava anche una epidermolisi bollosa di tipo distrofico. Quando le mancanze cutanee sono molto estese la mortalità è assai elevata; quando i tegumenti mostrano segni di necrosi è necessario provvedere con trapianti a lembo delle parti vicine, quando possibile, oppure con trapianti liberi.

RESUMO

O autôr relata três casos de deformações congênitas da pele, dois ocorridos em criança do sexo masculino nascidos de mães primiparas, e o terceiro atingindo grande parte da bochêcha direita, como tambem um dedo em cada mão.

Discorre sôbre o assunto, salientando as eventualidades surgidas nos dasos de tais mal-formações congênitas.

REFERENCES

1. Terruhn, E.: Arch. f. Gynak. 140:428, 1930.
2. Cordon, M.: J. de Med. Chir., Phar., etc. 26: 556, 1767.
3. Campbell, W.: Edinburgh J. M. Sc. 2:82, 1826.
4. Greig, D. M.: Edinburgh M. J. 103:341, 1931.
5. Herlitz, G.: Acta Pediat. 17:315, 1935.*
6. Davidson, L. T.: Am. J. Dis. Child. 59:371, 1940.*
7. Streeter, G. L.: Contrib. to Embryology 22: 1, 1930.**
8. Hebra, H.: Arch. Dermatol. 7:357, 1881.
9. Hoffman, V.: Wien. Med. Presse No. 18, 1885.
10. Kehrer, E.: Surg., Gynec. & Obst. (Abstract) 2:108, 1910.
11. Oing, M.: Zentralbl. f. Gynak. 53:1522, 1929.
12. Ingalls, N. W.: Am. J. Obst. & Gynec. 25: 861, 1933.

ADDITIONAL SOURCES

Abt, I.: Am. J. Dis. Children 14:113, 1917.
Anderson, N. P., and Novy, F. G.: Arch. Derm. & Syph. 46:257, 1942.

Adair, F. L., and Stweart, C. A.: Am. J. Dis. Child. 27:60, 1924.
Beatty, W.: Brit. J. Dermat. 9:301, 1897.*
Bonnaire, F.: Progres. Med. 13:481, 1891.
Callaway, J. L., and others: J. Pediat. 28:214, 1946.
Dowler, V. B.: Am. J. Dis. Child. 44:1279, 1932.
Emanuel, H.: Rep. Soc. Study Dis. Child. 6: 157. 1905-1906.
Elliott, G. T.: N. Y. M. J. 71:585, 1900.*
Engman, M. F., and Mook, W. H.: J. Cutan. Dis. 24:55, 1906.*
Fox, T.: Lancet 1:766, 1879.
Graff, E.: Zentralbl. f. Gynak. 45:705, 1921.
Guibout, M.: Union Med. 30:141, 1876.
Hahn, W. J.: J. d. Chir. u. Augenh. 30:156, 1841.
Heinrichsbauer, F.: Monatschr. f. Geburtsch. u. Gynak. 75:267, 1931.
Ingalls, N. W.: Quart. Rev. Biol. 7:47, 1932; Am. J. Path. 8:525, 1932.
Kaan, H. W.: J. Exp. Zool. 78:159, 1938.**
Kahn, E. A., and Olmedo, L.: Plastic & Reconst. Surg. 6:435, 1950.
Loewy, E.: Dermat. Wchnschr. 79:1660, 1924.
Lonne, F.: Zentralbl. f. Gynak. 45:1654, 1921.
Mace, O.: Bull. Soc. d. obst. de Paris 4:8, 1901.
Mall, M., and Meyer, L.: Contrib. to Embryol. 12:56, 1921.**
Peer, L. ., and Van Duyn, J.: Plastic & Reconst. Surg. 6:435, 1950.
Spemann, H., and Mangold, H.: Arch. Entwmech. 100:599, 1924.**
Sutton, R. L. Jr.: Arch. Derm. & Syph. 31:855, 1935.
Terfik, K.: Zentralbl. f. Gynak. 53:2898, 1929.
Van Eycken, E. J.: Plastic & Reconst. Surg. 9: 29, 1952.
Waddington, C. W., and Needham, D. M.: Proc. R. Soc. Med. London 117:310, 1935.**
*Epidermolysis bullosa.
**Embryology.

When a race lives in a rough mountainous country, bare of trees, and well watered, where great differences of climate accompany the various seasons, there the people will be of large physique, well-accustomed to hardihood and bravery, and with no small degree of fierceness and wildness in their character. On the other hand, in low-lying, stifling lands, full of meadows and where the water is warm, the people will be neither large nor slight, but rather broad in build, fleshy and black-haired. Their complexions are dark rather than fair and they are phlegmatic rather than bilious. Bravery and hardihood are not an integral part of their natural characters although these traits can be created by training. The people of a country where rivers drain the surface water and rain water have clear complexions and good health. But where there are no rivers and the drinking water is taken from lakes or marshes, the people will necessarily be more pot-bellied and splenetic. People who live in countries which are high, level, windswept and rainy tend to be of large stature and to show little variation among themselves. They are also of a less courageous and less wild disposition. In countries where there is a light waterless soil devoid of trees and where the seasons occasion but small changes in climate, the people usually have hard sinewy bodies, they are fair rather than dark and they are strong willed and headstrong in temperament. Places where changes of weather are most frequent and of the greatest degree show the greatest individual differences in physique, temperament and disposition among the inhabitants.

—*Hippocrates*

# Preliminary Report on a New Concept in the Operative Management of Lesions of the Supraspinatus Tendon

FREDERICK SYPHER, M.D., F.R.C.S., F.I.C.S.

TORONTO, ONTARIO, CANADA

*Man still bears in his bodily frame the indelible stamp of his lowly origin.—Charles Darwin.*

WHEN the shoulder is viewed in the light of its historical development it is clear that the supraspinatus muscle has entered the backwash of the evolutionary stream. It is a muscle which, with the emancipation of the foreleg from the process of locomotion, has changed its function. Moreover, it is unsuited to its new function and is relatively reduced in mass[1] and prone to degenerative change, awaiting its final removal in the continuing process of adaptation to the upright posture.

For many years the supraspinatus was thought to act as a prime mover,[2] the initiator of abduction. It is now generally accepted, in fact proved,[1] that, with contraction of the muscle, the increased tension in the line of the fibers of the supraspinatus tendon has no very important influence on abduction. Any such effect can be demonstrated electromyographically as coexistent with, and only very weakly additive to, the powerful deltoid contraction.

This article interprets some of the evidence provided by a consideration of comparative anatomy to support the contention that, in adaptation to the upright posture, the supraspinatus has changed its role, and that it is poorly adjusted to its new role. An understanding of this new role, based on a knowledge of the developmental process, suggests new methods in the surgical treatment of supraspinatus lesions, some of which will be discussed.

In the four-legged animal the supraspinatus is an efficient prime mover as well as a fixator. In the upright posture, considering the movement of abduction at the shoulder, a cuff tension tending to be crosswise of the main direction of the supraspinatus fibers is engendered by the action of the infraspinatus and subscapularis as they pull downward, backward and medially, one on either side of the shoulder blade. If one considered a point in the capsule immediately above the humeral head, this force, directed downward, backward and medially in the plane of the shoulder blade, can be resolved into a horizontal component maintaining the head of the humerus in contact with the glenoid fossa and a vertical component directed down the arm. The downward vertical component neutralizes the upward component of the deltoid pull, allowing the horizontal component of the deltoid to raise the arm away from the side of the body. The downward thrust on the head of the humerus, which prevents simply a hunch of the shoulder taking place when abduction is attempted, is the fundamental basis of this movement.

The horizontal component of the infraspinatus and subscapularis action, in addition to stabilizing the relation of the humeral head to the glenoid fossa, is important in maintaining the tension of the cuff across the top of the glenohumeral joint at an optimum value for different

Submitted for publication Feb. 10, 1954.

degrees of abduction. The supraspinatus of course assists in this, but, considering its relative size, this cannot be considered an essential function. Its new role is implicit in the fact that it does nothing more important than exist as a "bridge" over the humeral head, across which the subscapularis and infraspinatus transmit the depressor-fixator force without which abduction cannot take place. The effect of a tear of any size in this supraspinatus "bridge" is now obvious; the subscapularis and infraspinatus cannot act as a depressor-fixator of the humeral head; the dynamic influence of the cuff, as far as abduction is concerned, is destroyed. Now this might appear to illustrate the importance of doing nothing, provided it were done well; however, the supraspinatus portion of the cuff cannot provide an efficient bridge, because the important stress on its portion of the cuff tends to be crosswise of the main direction of its fibers, predisposing it to abnormal wear and tear and hence degenerative change, to which secondary inflammatory change adds its toll in the inhibition of function.

A way must be found, then, to eliminate the supraspinatus portion of the cuff and at the same time maintain efficiency in a "bridge" that will preserve the depressor-fixator force across the top of the glenohumeral joint. It will now be of interest to turn to the developmental history of the supraspinatus, to see how this muscle came to find itself in such a predicament, and then to consider more rational surgical approaches to the problem than have previously been tried.

*Developmental History of the Shoulder Girdle, with Particular Reference to the Supraspinatus.*—This phase of the developmental process requires some remarks about the fate of the intrinsic muscles, as noted in the amphibian necturus (Fig. 1), which converge to attach on the humeral head, and their intimate relation to the historical changes occurring in the coracoid element.

A useful frame of reference is the shoulder girdle of the duck-billed platypus (Fig. 2), because it illustrates changes covering the period between the amphibia and the early mammals; and with slight diagrammatic alterations, as noted in the legend, it can continue to illustrate the changes of the much later period occurring with the assumption of the upright posture.

*The Coracoid Element:* Phylogenetically the coracoid structure shows a progressive decline in importance, until in man, there is nothing left of it in the shoulder girdle but the well-known small nub of bone referred to as the coracoid process.

In amphibians the coracoid is a complex and important structure consisting of two distinct well-developed parts, the anterior

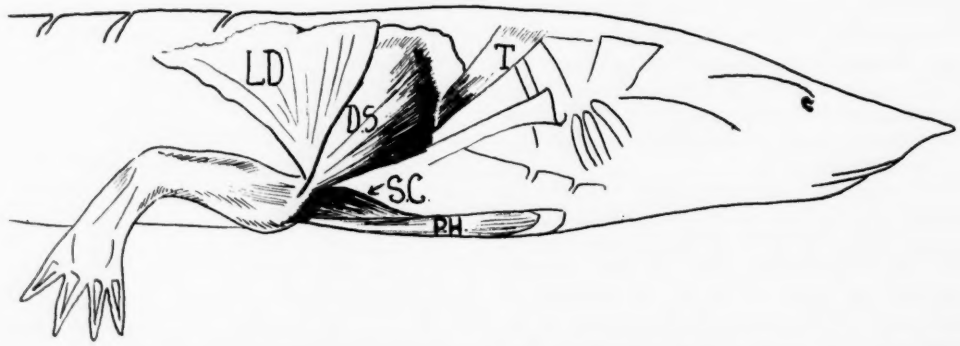



Fig. 1.—Shoulder musculature (semidiagrammatic) of Necturus, one of the most primitive living vertebrates. *D. S.*, dorsalis scapulae; *S. C.*, supracoracoideus; *P. H.*, procoracoideus or procoracohumeralis; *T.*, trapezius; *L. D.*, latissimus dorsi

(*pre, pro, epi*) coracoid and the posterior coracoid. The posterior coracoid is in some species referred to as the metacoracoid or just as the coracoid. The various parts of a primitive shoulder girdle can be picked out in Figure 2, which is a semi-diagrammatic representation of the shoulder girdle of the duck-billed platypus.

In the permian reptiles of more than two hundred million years ago the procoracoid is still well-marked. Somewhat later a group of ancient reptiles, known as the theraspids, showed a marked reduction in the procoracoid element. In the monatremes, a mammalian subclass, the procoracoid element is relatively very small, but the coracoid is still a well-developed structure. It is not until appearance of the marsupials and early placentals that progressive reduction of the coracoid element is in evidence. As the coracoid or posterior coracoid element diminishes, a new structure of intradermal ossification, called the clavicle, comes more and more into prominence as a strut between the manubrium sterni and the scapula. In relation to this, it is now necessary to consider the disposition of the primitive intrinsic shoulder musculature.

*Instrinsic Shoulder Musculature: Amphibian Necturus.* The amphibian necturus (Fig. 1) is one of the most primitive living vertebrates. It shows three sets of intrinsic muscles converging to an attachment at the head of the humerus.

*Dorsalis Scapulae.* The area of origin of this muscle comprises almost the entire dorsal surface of the relatively small blade of bone known as the primitive scapula. This muscle mass eventually splits off the teres minor; the main portion then becomes the deltoid. The deltoid portion has an origin that conforms ever more accurately to the region of the developing spine of the scapula (Fig. 2, *sp*). Eventually, to meet the demands for increased power in elevating the forelimb, the deltoid extends its origin by creeping over onto the lateral third of the clavicle.

*The Supracoracoideus.* This is associated with the primitive posterior coracoid process (Fig. 1, *sc*). This muscle mass eventually gives rise to the spinati, its point of origin migrating in the direction of the arrow (Fig. 2). This migration can be understood when considered as a response to the need of elevating the forelimb.

*The Procoracoideus.* This muscle mass disappears along with the procoracoid which gives it origin. It is lost somewhere along the line of human descent among the late amphibians or the early reptiles.

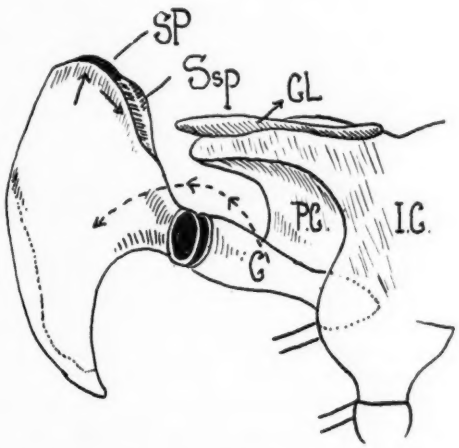



Fig. 2.—Shoulder girdle of the platypus (ornithorhynchs). *C.*, coracoid or postcoracoid. This is still a well marked structure but due to disappear except for the small lateral remnant known in man. Arrow with dotted line shows direction of migration of supracoracoideus musculature. *P. C.*, procoracoid—still evident in this form but rapidly disappearing. *S. P.*, spine of scapula, slightly exaggerated to emphasize its increasing importance in later forms. It is raised from the surface of the scapula, with the increasing importance of giving origin to the deltoid and making space on the posterior surface of the scapula for the transferring fibers of the supracoracoideus. Arrows denote directions of enlargement of this part of the scapula (see text). *S. S. P.*, supraspinous portion of the scapula. This part of the scapula does not actually appear until the appearance of the higher mammals. Its position is indicated here to show its future relation. It accommodates those fibers of the supracoracoideus which are prevented from reaching the main posterior scapular surface by the enlarging spine of the scapula and is best developed in those forms when stability of foreleg weight-bearing is of prime importance (note scapula of stag and dog in Figure 3). *I. C.*, Interclavicle. *C.*, clavicle—a dermal element developing as a strut to enter into a joint with the developing acromial end of the spine of the scapula.

*Emancipation of the Foreleg from the Process of Weight Bearing:* When the animal of a million or two years ago began to test the possibility of assuming an erect posture the coracoid element was a diminishing structure, but the spine of the scapula (Fig. 2, *sp*) was coming more and more into prominence; evidence, no doubt, of the increasing size and importance of the dorsalis scapulae attached to its lower side and the trapezius to its upper side. However, abduction could not be provided for by the dorsalis scapulae, since alone it could exert only a vertical force, pulling the arm up in the line of its long axis. A depressor and fixator of the humeral head was required from any muscle mass capable of responding to this need. The dorsalis scapulae action had to be divided into a horizontal and a vertical component and the vertical component neutralized.

The supracoracoideus musculature, as seen in the early amphibians, is not in a suitable position to give this necessary aid, but as the deltoid migrated from the surface of the scapula, concentrating its origin on the enlarging spine of the scapula, space was correspondingly available on the posterior surface of the scapula, deep to the deltoid. The supracoracoideus, gradually shifting to this new point of origin, as indicated by the arrow in Figure 2, finds a more favorable direction of pull. Its old origin, the posterior coracoid, progressively disappears.

As recently as the period of transition between the reptiles and the early placentals, the supraspinous portion of the scapula as represented in the duck-billed platypus (Fig. 2, *ssp*) is practically nonexistent. This part of the scapula is slightly exaggerated in the diagram to show its position. It becomes an easily recognizable part of the structure only in the higher mammals, and one must assume that accommodation for all the transferring fibers of the supracoracoideus could not be found on the posterior surface of the scapula before the ever-enlarging spine of the scapula, by extending laterally in the direction of the future acromion, prevented some of them from joining the main infraspinous muscle mass. The supraspinous portion of the scapula may be looked upon as developing to take care of the origin of the fibers now known as the supraspinatus muscle, the degree of development corresponding to whatever need existed in a given species for stability in foreleg weight bearing.

This supraspinous portion of the scapula varies in importance indirectly according to the degree to which a given species emancipates its forelimb from the process of locomotion. The bat, for example, since its forelegs are not put specifically to weight-bearing use, has a scapula with a relatively small supraspinous portion shaped much the same as man's. Animals that take an almost vertical pressure on their glenoid have a triangular scapula, with supraspinous and infraspinous portions of almost the same size. In the higher primates the infraspinous part of the scapula shows a marked tendency to become progressively larger, the supraspinous portion smaller. The disproportion in favor of the infraspinatus reaches its maximum in man.[3] Figure 3 shows comparative views of the scapulae of some of the higher vertebrates.

Owing to the position of the arm at the side of the body and the consequent rotation of the humeral head,[4] the insertion of the supraspinatus on the humerus is so close to its fulcrum, and its line of pull is such, that the muscle can but ineffectually imitate the deltoid, and, with the more favorably placed subscapularis in front and the infraspinatus behind, it is not needed to stabilize or depress the humeral head. Its important function now is to provide the bridge already referred to between the anterior and posterior cuff muscles, but its fibers, still dedicated to their historic role, run laterad. Therefore, when the subscapularis and infraspinatus contract, the strain on the supraspinatus part of the cuff is predominantly in the anteroposterior direction. The fibers of the supraspinatus will then have a stress applied that tends to separate them. So, just as in some other arena the ancient pro-

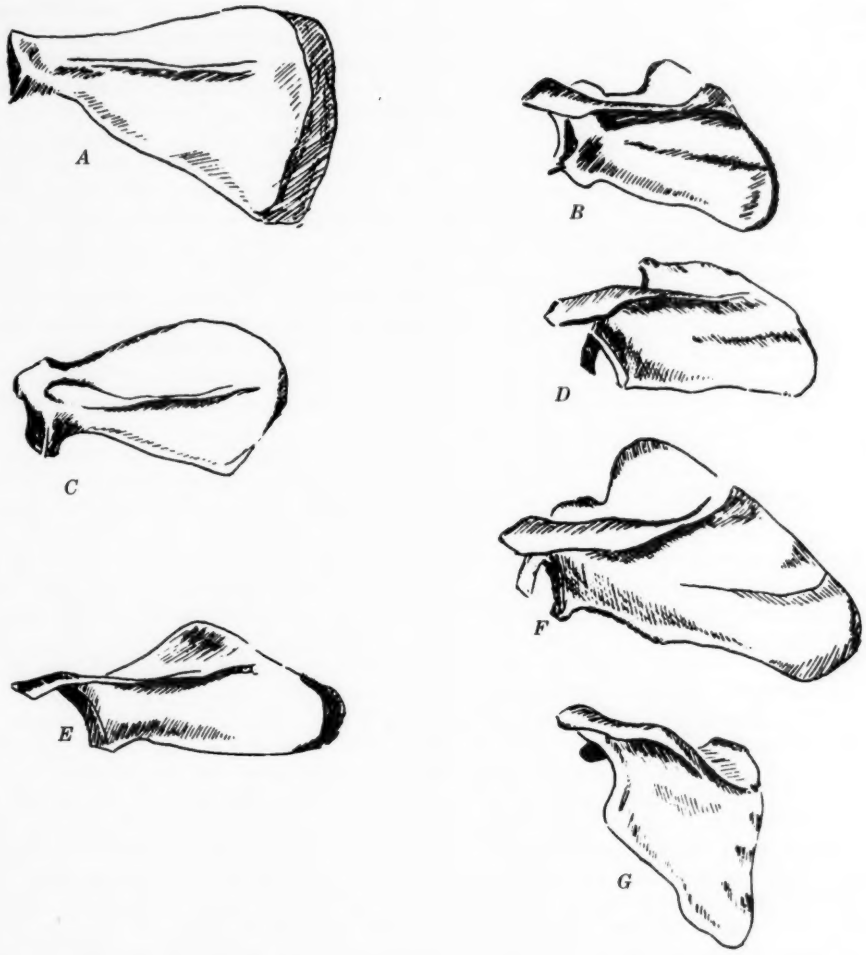



Fig. 3.—Scapulae of some of the higher vertebrates: *A*, stag; *B*, orangutan; *C*, dog; *D*, chimpanzee; *E*, hylobatic vertebrate; *F*, gorilla; *G*, man. In quadripedal types the scapula tends to be a triangular plate with a rather deep glenoid cavity at outer angle and a spine which approximately bisects this angle forming supraspinous and infraspinous portions of approximately equal size and importance. In man and higher species, note the shallow glenoid, vertical vertebral border and relatively small supraspinous portion. The intermediate features of the hylobates are considered to be an early apelike type on the line of human descent.

coracoideus muscle must have failed in the struggle for adaptation, the supraspinous part of the supracoracoideus, i. e., the supraspinatus, in reference to the upright posture, is seen to be the victim of its inability to adjust to changing circumstances.

*The New Rationale for Operative Repairs of Supraspinatus Tendon Defects.*—On the foregoing theoretical basis one can widely remove all the degenerated area of the cuff with impunity, provided the depressor-fixator action of the subscapularis and infraspinatus on the head of the hu-

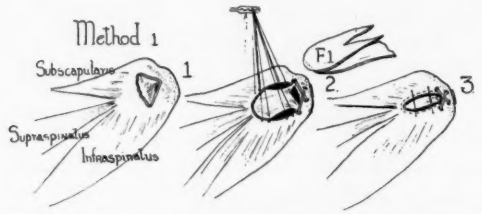



Fig. 4 (Method 1).*—Large original triangular defect and double layer of fascia lata.

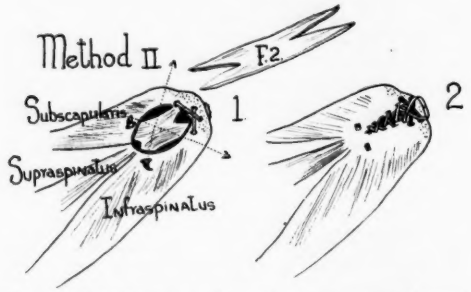



Fig. 5 (Method 2).—Insertion of the H-shaped fascia $F_2$, a single sheet, with provision for lacing.

merus is maintained. Inability to elevate the arm in the presence of a large tear of the cuff can have nothing of any significance to do with the muscle activity of the supraspinatus, but results from a slackening off of the anterior and posterior muscles of the cuff. This slackening is considered, of course, in relation to the dynamics of the tension in the capsule above the head of the humerus and not of the action of the individual muscles. There are doubtless many practical technics which, to a certain extent, satisfy the theoretical requirements. Several methods which have occurred to me are presented. Some of these have been tested in actual practice, with encouraging early results. Method 4, in my opinion, most accurately reflects the theoretical data, but as yet there has not been an opportunity of trying it in practice. The earlier methods are mentioned since they show the manner in which treatment has evolved to date.

*Method* 1 (Fig. 4): A double layer of fascia lata is inserted to fit the defect in the cuff after all the degenerated portion has been removed. Mattress sutures placed *front and back* allow one to fix the patch under appropriate tension. One end of the patch has tails, left long, which are anchored in bone at the greater tuberosity. Two of the catgut mattress sutures are tied from front to back over the patch, as indicated in the diagram, to give added security.

*Method* 2 (Fig. 5): An H-shaped piece of fascia is used, the central portion being large enough to cover the exposed head of the humerus. The tails on either end are anchored as shown, one set in the bone at the greater tuberosity, the other set laced up with a pull in the direction of the dotted line, exerting whatever seems to be the correct tension in the anterior and posterior musculature.

*Method* 3 (Fig. 6): A single layer of fascia lata is placed in the defect over the humeral head after the degenerated layer of cuff has been removed. It needs only to be sutured lightly in place. A separate strip of fascia is then inserted in a figure of eight as shown in the diagram. It is now not considered necessary for the fascia actually to pass through bone. The ends of the strip can be passed through the cuff on either side of the defect close to the greater tuberosity and firmly anchored after the correct amount of tension has been applied.

*Method* 4 (Fig. 6): This method most accurately fulfills the theoretical requirements. It is suggested that the fascial patch now be discarded, since it is not considered necessary to close the defect by a continuous layer as long as the optimum tension can be maintained in the subscapularis and infrapinatus and transmitted to the head of the humerus to supply the depressor-fixator action. For this, two strips of fascia are required. One

*These are diagrammatic representations of the three cuff muscles. To be anatomically accurate, the fibers of the subscapularis would of course have to be shown converging on the lesser tuberosity of the humerus, with a seam of capsule along the line of the long head of the biceps interposed between its fibers and those of the supraspinatus, but since the dynamics of elevation of the arm are under consideration, rather than medial rotation of the humerus, the lines of tension are shown consistent with the function of the subscapularis as an anterior anchor of the shoulder capsule.

strip is placed so as to draw the anterior cuff into a pleat. The other forms a similar pleat in the posterior cuff. These pleats run at right angles to the muscle fibers which have been slackened off by the defect. These fibers can now be drawn out to physiologic tension and their site of action transferred to the outer point of the shoulder by the two fascial strips. When the strips are anchored to the cuff close to the point of attachment to the greater tuberosity, in a position like that indicated in the diagram, they can be sewed together at the points where they cross, to add security to their insertion.

The shoulder strap incision should be used in any of these methods and should extend back far enough to clear the posterior border of the acromion. Although it has been my practice in the past to remove the overhanging of the acromion, it is now, for reasons to be set forth later in this paper, considered wrong in principle to do so. This adds most decidedly to the desirability of Method 4, since it is thought that the other methods would be impossible without the added exposure provided by removal of the acromion.

*Postoperative Care.* — The shoulder should be maintained in a plaster of paris spica with 90 degrees of abduction, 80 or 90 degrees of lateral rotation, and slight forward flexion for ten days to two weeks. After this the type of balanced traction shown in Figure 7 is used. This is an adaptation of the Russell traction, in which the upper pulley suspension is not fixed rigidly but fastened to the runner on a 24-inch (59 cm.) strip of curtain rod. This allows the degree of rotation at the glenohumeral joint to be altered either actively or passively. At first the position is changed passively at intervals during the day. Gradually, increasing participation by the patient in this movement is permitted under the supervision of a physiotherapist. In two or three weeks the patient is taken out of this apparatus and allowed to be up, in a right-angle abduction splint. The splint is removed gradually, allowance being made for increasing activity in the physiotherapy program. The length of this convalescent period necessarily varies with the amount of muscle rebuilding and reeducating required in the individual case.

## COMMENT

A workman past middle age who must continue on a fairly heavy job urgently requires a better method of treatment for a severely degenerated cuff lesion than has hitherto been employed. As a test of the operations here described, patients are being selected who have unmistakable evidence of a large cuff tear. The glenohumeral joint should be free from all but very mild osteo-arthritic change, and, in a general way, the patient should be reasonably alert, active, and well-motivated on the question of returning to work.

Small to moderate tears occurring in relatively young, muscular persons as the result of severe strain, when there is little or no evidence of degenerative change in the cuff, should be treated as described by McLaughlin,[5] with due recognition of the triangular formation of the defect and the resultant necessity of approximating the edges of the defect in a special way. In older persons the tear is usually based on a well-established degenerative lesion, and if there is any doubt about the extent of the degenerative process, one of the more radical procedures suggested here is indicated. My own experience is so far based on Methods 1 and 2. Method 4, however, recently devised, will be from now on the

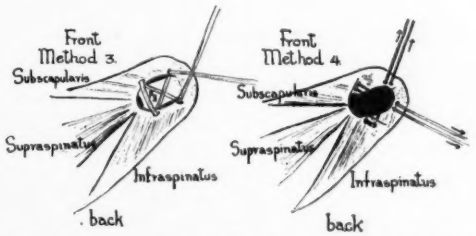



Fig. 6.—*Left* (Method 3), figure of eight fascial band with single layer of fascia lata sutured lightly in place. *Right* (Method 4), procedure of choice: pleating of cuff on each side of defect. Two strips of fascia lata are used, but no fascial patch.

method of choice, since it removes permanently the supraspinatus portion of the cuff where the predominant direction of the fibers is unfavorable, and therefore may be looked upon as anticipating a further step in the change being effected by the evolutionary process in the adaptation to the upright posture.

In the past it has been considered technically necessary to remove the acromion. The acromion, however, first gains particular importance is association with the upright posture (Fig. 3). Also, from a strictly mechanical point of view,[1] the abduction force of the deltoid varies according to the sine of the angle its fibers make with the humerus. Therefore, the less the acromial overhang the smaller this angle and the more nearly the abduction force component of the deltoid approaches zero. In my opinion Method 4 (Fig. 6) will allow the degenerated cuff to be widely excised, the depressor-fixator effect preserved and the acromion left intact without significantly increasing the technical difficulties. The details of this method will be reserved for the follow-up paper on case material.

The supraspinatus, as its developmental history shows, has failed to change with changing circumstances and has been left with a function which it is poorly adapted to perform. Any method, therefore, of dealing with supraspinatus lesions that widely removes the degenerated portion of the cuff and preserves the depressor-fixator effect of the subscapularis and infraspinatus muscles may be expected to succeed. Gibson[6] has stated that he has been successful in most cases of frank cuff tear with a program of muscle reeducation. This must mean that under proper guidance, in certain cases at least, a readjustment to the change of muscle tension can take place after a cuff tear and the depressor action of the subscapularis and infraspinatus be regained. From the theoretical considerations presented here one would not be surprised at this, particularly with small tears, but at the same time one would not expect good results to be the rule in the hands of most surgeons.

Even though a good range of movement may be regained by a conservative method of treatment, a rather marked loss of power, due to change in length of muscle fiber, must occur in most cases. Also, degenerated cuff remnants may continue to act as centers of inflammatory reaction. In my experience these factors combine in most cases to constitute a fairly severe permanent disability.

When a defect is observed in the supraspinatus and an attempt is made to close it, the superficially logical thing is being done, but the historical process is being ignored; thus one is unwittingly resisting an inevitable change. In denying this change, man would have no recourse but to get down and walk on all fours in an absurd attempt to reverse the events of the past two million or so years. No wonder the results of treatment are poor.

The implications here go beyond this particular problem. In general, there is a deceptive element in looking at anything as a "thing in itself." In order to make a correct appraisal one must become fully aware of a thing in its interrelation with other things, of the the way in which new qualities appear as each particular equilibrium of forces is from time to time superseded. When, in reference to a particular thing, the natural process of its change is understood, one has the opportunity of anticipating events and intelligently adjusting one's own behavior. Ignoring or resisting or denying change does not influence its fundamental character or alter the inevitable necessity of eventually making the adjustment to it.

It is hoped, therefore, that this article will point the way to a standardized method of aiding nature to eliminate the incompetent supraspinatus, reestablish physiologic tensions in the posterior and anterior cuff muscles, and lead to uniformly good results. The early indications are that this aim will be achieved, and a further report will follow when sufficient case material has accumulated. It is hoped, too, that the evaluation process will be speeded up by others who find interest in this general approach to the problem.

## SUMMARY

1. Phylogenetic data are presented to outline the main points in the developmental history of the supraspinatus muscle.

2. A new concept in the treatment of supraspinatus lesions is based on the perspective gained by considering the supraspinatus from the standpoint of its developmental history.

3. Four operative methods based on this new concept are discussed. Method No. 4 is considered most likely to give the best results.

4. Although sufficient clinical material is not yet available to provide a statistically valid test for this concept, early results with the first two methods are encouraging. The hope is expressed that the best procedure will become standardized more quickly if attention is focused now upon the developmental aspects of the supraspinatus.

## RÉSUMÉ

1. L'auteur présente la phylogénèse du muscle sus-épineux.

2. Une nouvelle conception dans le traitement des lésions du muscle sus-épineux est précisément basée sur cette phylogénèse.

3. Parmi quatre méthodes opératoires que l'auteur propose, il choisit la quatrième, celle-ci donnant les meilleurs résultats.

4. Bien que le matérial clinique ne permette pas encore d'établir une statistique intéressante, les résultats immédiats obtenus sont encourageants. Si l'on tient compte, dans les lésions du muscle sus-épineux, de cette nouvelle technique, on exprime l'espoir que le meilleur procédé sera rapidement standardisé.

## ZUSAMMENFASSUNG

1. Die wichtigsten Punkte der Entwicklungsgeschichte des M. supraspinatus werden an Hand von phylogenetischen Angaben dargestellt.

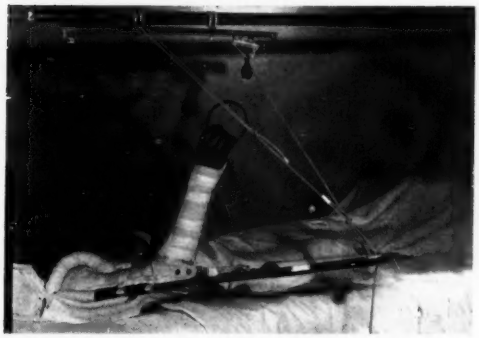



Fig. 7.—Balanced traction apparatus for use in postoperative care (see text). Permits early graded activity at shoulder. Also, patient can sit up without significantly altering the balance of forces.


2. Die Erkenntnisse, die aus der Betrachtung der Entwicklungsgeschichte des M. supraspinatus gewonnen werden, führen zu einer neuen Auffassung von der Behandlung der Schädigungen dieses Muskels.

3. Es werden vier Operationsmethoden erörtert, die auf dieser neuen Auffassung basieren. Die zuletzt besprochene Methode scheint die besten Ergebnisse zu zeitigen.

4. Obgleich das vorliegende klinische Material noch nicht umfangreich genug ist, um die Richtigkeit der neuen Auffassung statistisch zu bekeisen, so sind doch die mit den ersten beiden Methoden erzielten Ergebnisse ermutigend. Es wird der Hoffnung Ausdruck gegeben, dass sich die beste Methode schnell zu einem Standardverfahren entwickelt, wenn in Zukunft die Entwicklungsgeschichte des M. supraspinatus im Auge behalten wird.

## RESUMEN

1. Se presentan datos filogenéticos para delinear los puntos principales en el desarrollo filogénico del músculo supraespinoso.

2. Se basa un nuevo concepto en el tratamiento de las lesiones supraespinosas, bajo la perspectiva obtenida de la consideración filogénica del supraespinoso.

3. Se discuten cuatro métodos operatorios basados en este nuevo concepto. Se

consideró que el método No. 4 es el que proporciona los mejores resultados.

4. Aun cuando no se dispone todavía de validez estadística, los resultados de los primeros dos métodos son alentadores. Se expresa la esperanza de que el mejor procedimiento se volverá más rapidamente estandard si se enfocan los aspectos de desarrollo del supraespinoso.

RESUMO

1. São apresentados pelo autôr dados filogenéticos para estandartisar os principais pontos da historia do desenvolvimento do musculo supra-espinhosa.

2. Um novo conceito para tratamento dasl esões supraespinhosas é apresentado pelo autôr que justifica a base do mesmo.

3. Quatro processos cirúrgicos baseados nêsse novo conceito são discutidos, considerando o autôr o quarto metodo como aquêle que oferece melhores resultados.

4. Discute o autôr os demais metodos apresentados, criticando-os quanto aos resultados e conceito dos mesmos, focalisando a base que deve preceder a escôlha do tratamento para cada caso.

RIASSUNTO

1. Viene illustrata la filogenesi del muscolo sopraspinoso.

2. In rapporto alla storia del suo sviluppo vengono prospettati nuovi punti di vista nella cura delle sue lesioni.

3. Vengono presentati 4 metodi operatori, fondati su questi nuovi concetti. Uno di essi, in particolare, fornisce ottimi risultati.

4. Non vi è ancora una documentazione sufficiente, ma i primi risultati sono incoraggianti. Ci si augura che la tecnica verrà ben presto messa perfettamente a punto.

REFERENCES

1. Inman, V. T.; Saunders, J. B., and Abbott, L. C.: Observations on the Function of the Shoulder Joint, J. Bone & Joint Surg. **26**:1, 1944.

2. Gray's Anatomy. Edited by T. B. Johnston. New York: Longmans, Green & Co., Inc., 1935. McMurray, T. P.: A Practice of Orthopaedic Surgery. London: Edward Arnold & Co., 1949.

3. Hopf, G.: Human Species. London: Longmans, Green, & Co., Inc., 1909. Inman and others.[1]

4. Dickson, J. A., and O'Dell, H. W.: A Phylogenetic Study of Recurrent Anterior Dislocation of the Shoulder Joint, Surg. Gynec. & Obst. **95**: 357-365, 1952.

5. McLaughlin, H. L.: Lesions of the Musculotendinous Cuff of the Shoulder, J. Bone & Joint Surg. **26**:31-51, 1944.

6. Gibson, A.: Personal communication, January 1952.

ADDITIONAL SOURCES

Belton, A. A., and Davies, F.: Supraglenoidal Pseudoarthrosis, J. Bone & Joint Surg. (British Section) **33B**:629-633, 1951.

Keith, A.: Human Embryology. London: Edward Arnold & Co., 6th ed. 1948.

Neal, H. V.: Chordate Anatomy. Philadelphia: Blakiston Company, 1946.

Wilder, H. H.: History of the Human Body. New York: Henry Holt and Company, 1923.

The mystery of mysteries is to view machines making machines; a spectacle that fills the mind with curious, and even awful speculation.

—*Disraeli*

# Massive Arterial Thrombosis

PAUL S. LOWENSTEIN, M.D., F.A.C.S., F.I.C.S.

ST. LOUIS, MISSOURI

THE preponderance of the literature concerning thrombosis of arteries and veins deals with the physical nature of the clot and the organic changes in the vessels associated with it. The great complexity of the problems associated with thrombosis was reviewed some years ago by Silberberg[1] and more recently by Wright,[2] who pointed out the inadequacy of present-day tests for such vital determinants as clotting factors. Some of the current writing on the subject discusses thrombosis appearing in disorders of the blood or blood-forming organs and attempts to determine certain biochemical or physicochemical factors associated with it.

Arteriosclerosis obliterans, thromboangiitis obliterans and embolism are responsible for the vast majority of arterial occlusions. As was pointed out by Allen, Barker and Hines,[3] "When sudden arterial occlusion occurs in the presence of characteristic evidence of thromboangiitis obliterans or arteriosclerosis obliterans, it can be attributed to thrombosis occurring as a part of the diseases mentioned. It is when no obvious cause exists that difficulty is encountered in explaining the situation. Then the best that can be done is to hazard a guess after all available information is considered."

In presenting the following case of massive arterial thrombosis in the absence of demonstrable organic disease of the blood or blood vessels, I searched in vain for an explanation in fifteen monographs on peripheral vascular disease and in the literature of the last ten years. The nearest comparable condition, idiopathic simple arterial thrombosis, was described by Nygaard and Brown[4] under the term "essential thrombophilia." Their patients presented sudden and severe arterial occlusion in the absence of demonstrable blood dyscrasia or disease of the heart or blood vessels. However, the authors observed increased coagulability of the blood plasma and an increase in blood platelets during the thrombotic episodes, and expressed the opinion that the condition was a separate disease entity.

## REPORT OF A CASE

Miss C. H., a 45-year-old white public accountant, was referred to me because twenty-four hours earlier she had suddenly lost the use of her left leg. I first examined her on July 24, 1952, after her admission to the Jewish Hospital by ambulance.

She recounted a rather vague history of discomfort in both legs for several weeks. On one or two occasions her friends had noted blueness of her lips, and a sister stated that as long as five years ago this had been noted occasionally. A week before admission "phlebitis" developed in the middle part of the right leg but improved with rest. There had been some pain in each leg, which her physician had been inclined to attribute to hysteria. One day before admission she was suddenly unable to move the left leg, and there was a great increase in pain in the left leg and to some extent in the right. There had recently been some rather severe dyspnea, but no cough or hemoptysis. There were no symptoms referable to the gastrointestinal or the urinary system, and the menstrual history was normal. The patient had never used tobacco or alcohol.

Examination revealed her to be very stout and in obvious distress because of pain in the legs (especially the left). The lips, tongue and nail beds were all somewhat cyanotic, but there was no orthopnea. The radial pulse rate was about 110, but the rhythm was regular (although a nurse who examined it on admission said it was irregular). No femoral,

From the Departments of Surgery and Pathology, Jewish Hospital.

Read at a Regional Meeting of the International College of Surgeons, St. Louis, March 31, 1953.

Submitted for publication Jan. 4, 1954.

popliteal or pedal pulsations could be detected in either leg, and both feet were cool and slightly mottled (the left more than the right). On the following morning there was a marked increase in cyanosis of the left leg up to the knee and of the right in the lower areas. The heart and lungs were normal. The abdomen was also normal, except for obesity. Pelvic examination was difficult because the patient was unable to flex her knees, but a firm, irregular mass was palpated, completely filling the pelvis.

A roentgenogram of the chest and an electrocardiogram were normal. The urine showed albumin (3 plus) and an occasional granular cast and red blood cell. The leukocyte count was 13,800 per cubic millimeter of blood, but the differential count was within normal limits. There was 14.5 Gm. of hemoglobin (94 per cent). A Kahn test of the blood gave negative results.

Because of the impression that the pelvic mass might be exerting pressure on the vascular system of the lower extremities, an immediate operation was undertaken, with nitrous oxide-oxygen-ether anesthesia. Through a suprapubic midline incision two large uterine tumors, almost completely filling the pelvis, were revealed, and, because of the possibility that they were malignant, total hysterectomy was performed. After this, palpation revealed good pulsations of the right common iliac, external and hypogastric arteries. On the left, the same arteries from the bifurcation of the aorta distally were pulseless and rigid. A left transperitoneal lumbar sympathectomy was performed and the wound closed in layers. Pathologic examination of the pelvic tumors revealed multiple myomas of the uterus with adenomyosis. The patient stood the operation fairly well, but the anesthetist stated that her face was cyanotic during most of the procedure, despite liberal use of oxygen. Immediately after the operation it was noted that the left thigh and knee were warmer than the right and that the cyanosis, which had extended almost to the hip preoperatively, had now receded to the midportion of the leg. The patient was given Depo-Heparin and Dicumarol. The blood clotting time and the bleeding time as determined after the administration of heparin had been discontinued were normal, and the platelet count was also within normal limits (200,000 to 327,000). The values for blood sugar and nonprotein nitrogen were normal; total proteins amounted to 5.3 Gm., and the albumin-globulin ratio was 0.96.

Several days after the operation the cyanosis of the lips and fingers disappeared. The patient's general condition remained fairly satisfactory, but the condition of the legs steadily deteriorated, with the development of frank gangrene of the lower half of each. On August 3, with cyclopropane anesthesia and with two surgical teams working, the right thigh was amputated at its middle and the left at its upper third, a circular no-flap method being used. No arterial bleeding was encountered, and many of the veins were thrombosed. Examination of the amputated limbs revealed thrombosis of many of the major arteries and veins. Microscopic sections showed in addition, some subintimal thickening of the major arteries and in some areas slight subintimal calcification. A blood transfusion of 2,000 cc. was given during and immediately after the operation, which the patient withstood fairly well. For several days her condition apparently was relatively unchanged, but toward the end of the week there was a rise in temperature, accompanied by some abdominal distention and vomiting. On Aug. 9, 1952, she suddenly became cyanotic and died.

At autopsy, performed four hours after death, the essential observations were thrombosis of the following arteries: the left iliac, left femoral, right femoral and profunda femoris, superior mesenteric, splenic, both renal, right colic, right upper pulmonary and left lower pulmonary. There was recent infarction of the lungs (multiple), of the spleen, of the kidneys (old and recent), of the small intestine and of the ascending and proximal two-thirds of the transverse colon. The heart presented a patent foramen ovale with a flap, probably nonfunctional. There was mild cirrhosis of the liver.

I am indebted to Dr. Herman Blumenthal, the pathologist to the hospital, for the following summation of the clinical and postmortem features: "We are of the opinion that the uterine fibroids recently removed were not responsible for the thrombotic phenomenon which apparently first involved the vascular tree leading to the lower extremities, since we have seen considerably larger fibroids on many occasions without such an outcome. Nor is there anything within the walls of the various arteries studied at autopsy which would account for the thrombosis. Arteriosclerosis of the aorta is minimal, and the primary and secondary branches leading from the aorta

show no noteworthy sclerotic change. It is common to see a much greater degree of arteriosclerosis without any thrombotic phenomenon. Similarly there is no intrinsic vascular inflammatory reaction of a general character, such as periarteritis nodosa, which would account for the extensive thrombosis.

"One is therefore forced to look to the blood in the form of some chemical factor. A physical factor, such as abnormal slowing of the blood stream, was apparently not operative, since the heart was only slightly enlarged (400 Gm.), and the small healed infarct was certainly not enough to account for such an effect, particularly since there was no evidence of decompensation in the form of chronic passive congestion of lungs, liver or spleen. The myocardial infarct very likely followed the onset of these thrombotic episodes and was quite small. Since an analysis of possible chemical factors leading to such a universal clotting phenomenon is not within the possibilities of the anatomic approach, any further discussion would only be in the form of conjecture."

An explanation of the transient episodes of cyanosis might be the presence of a ball-valve thrombus at the mitral orifice. Since none was observed at autopsy, this is purely hypothetical. That this case does not belong in the category of those described by Nygaard and Brown[4] would seem to be evidenced by the normal clotting time and platelet count.

One is thus compelled to classify this condition as idiopathic thrombosis, which is an admission of the limitations of present knowledge with regard to intravascular clotting. One must therefore hope that further physicochemical research may offer the solution.


## SUMMARY

The author reports a case of massive arterial thrombosis in the absence of demonstrable disease of the blood or the blood vessels. Amputation of both legs was necessary, and examination of these revealed thrombosis of many of the major arteries and veins. Although the case was necessarily classified as a case of idiopathic thrombosis, the author states that further physical and chemical research will be needed to determine the precise nature of the condition.

## RÉSUMÉ

L'auteur rapporte cas de thrombose artérielle sans affection de la crase sanguine ou sans lésion des vaisseaux sanguins. Dans ce cas L'amputation des deux jambes a été nécessaire. L'examen des jambes révéla des thrombose de plusieurs artères et veines. Quoique le cas fût classé parmi les cas de thrombose idiopathique, l'auteur déclare que des examens ultérieurs physiques et chimiques seront nécessaires pour déterminer la nature exacte de cette thrombose.

## ZUSAMMENFASSUNG

Der Verfasser berichtet über einen Fall umfangreicher arterieller Thrombose ohne das Bestehen nachweisbarer Erkrankung des Blutes oder der Blutgefässe. Beide Beine mussten amputiert werden, und die Untersuchung der entfernten Gliedmassen zeigte Thrombosen in zahlreichen grösseren Arterien und Venen. Der Fall musste als idiopathische Thrombose bezeichnet werden; der Verfasser glaubt, dass zur Bestimmung des genauen Wesens der Erkrankung weitere Arbeiten auf dem Gebiete der physikalischen und chemischen Forschung notwendig sind.

## RESUMEN

El autor comunica un caso de trombosis arterial masiva en ausencia de padecimiento demostrable en sangre ó vasos sanguíneos. Fué necesaria la amputación de ambas extremidades inferiores y el exámen de estas reveló trombosis de muchas de las arterias y venas grandes. Aun cuando el caso fué clasificado necesariamente como trombosis idiopática, el autor establece que se requiere investigación física y química posterior para determinar la naturaleza percisa del padecimiento.

## RIASSUNTO

Viene riferito un caso di trombosi arteriosa massiva senza alcuna malattia del

sangue o dei vasi. Fu necessaria l'amputazione di en trambi gli arti inferiori, e in essi si trovarono molti vasi venosi e arteriosi trombosati. Il caso fu classificato come idiopatico, benchè lo stesso autore riconoscesse che sarebbero stati necessari ulteriori esami per stabilire la natura dell'affezione.

RESUMO

O autôr relata um caso de trombose arterial massiça em um doente onde mão existia qualquer sintôma de doença sanguinea os vascular. Foi necessaria uma amputação de ambas as pernas, revelando o exame posteriôr trombose da maioria dos grandes vasos arteriais e venosos. Necessariamente se deve classificar tal caso como de trombose idiopatica, salientando o autôr da necessidade e da importancia de sêrem realisados vários exames fisicos e quimicos que devem determinar e precisar a natureza da afecção.

REFERENCES

1. Silberberg, M.: The Causes and Mechanism of Thrombosis, Physiol. Rev. 18:197, 1938.
2. Wright, I. S.: The Pathogenesis and Treatment of Thrombosis. New York: Grune & Stratton, 1952.
3. Allen, E. V.; Barker, N. W., and Hines, E. A. Jr.: Peripheral Vascular Diseases. Philadelphia: W. B. Saunders Company, 1946.
4. Nygaard, K. K., and Brown, G. E.: Essential Thrombophilia, Arch. Int. Med. 59:82, 1937.

Omit a few of the most abstruse sciences, and mankind's study of man occupies nearly the whole field of literature. The burden of history is what man has been; of law, what he does; of physiology, what he is; of ethics, what he ought to be; of revelation, what he shall be.

*—Finlayson*

There is no kind of praise which has not been bestowed on prudence; nevertheless, however great it may be, it cannot assure us of the least event, because its subject is man—the most changeable in the world.

*—La Rochefoucauld*

A man morally small resembles a statue in this respect: the higher he is elevated, the more he dwindles. There are men that do well enough on the ground; but, if they are set on a lofty pedestal, we cannot for the life of us determine whether they are men or monkeys.

*—O'Malley*

Whatever corrupts the ideal of perfection which man should form of himself, in any sphere, diverts good at its very source.

*—Joubert*

Those who are quite satisfied, sit still and do nothing; those who are not quite satisfied, are the sole benefactors of the world.

*—Landor*

# Rhinoplastic Surgical Problems

LOUIS J. FEIT, M.D., F.A.C.S., F.I.C.S.

NEW YORK CITY, NEW YORK

SINCE rhinoplasty is now recognized as an integral part of rhinology, and its basic procedures established, I shall discuss the more unusual problems arising in this type of surgical practice.

Before undertaking a rhinoplastic operation, the surgeon must ask himself these questions and answer them to his satisfaction:

1. Is the patient in good physical condition, so that the healing processes will be maximal? If not, the desired cosmetic result may not be attained even though all details of technic are scrupulously followed.

The patient's age is important. Ideally, the operation should be performed on patients above 16 years of age. For obvious reasons, the chances of greatest improvement decrease with advancing age, while in the preadolescent years the necessary fracturing of the facial bones may result in greenstick fractures.

2. How much improvement can be expected, and will function be sacrificed to cosmetic gains?

3. What is the purpose of the operation? In planning the operation, of course, one must have a clear concept of the end result. Will the remodeled nose be in harmony with the other features and in proportion to them? The reconstruction must be so planned as to conform to the structure and dimensions of the other features.

For preoperative evaluation of the individual problems of each patient, a complete case history is obtained and a thorough physical examination made. Then a detailed analysis is made of the nasal pyramid and its related structures. These data are comprehensively and conveniently summarized on the patient's file card (Fig. 1).

When the analysis of the case is complete, the type of procedure is determined. A quick review of the anatomic structures of the nose with relation to the flow of air current may simplify discussion.

Figure 2 shows the nasal pyramid, with the contiguous portion of the septum; Figure 3, the component parts of the septum: (a) the ventral compartment (*i*, caudal portion; *ii*, cephalic portion) and (b) the dorsal compartment.

The effect of the various compartments on the air current is shown in Figure 4. At the juncture of the upper and lower cartilages there is sphincteric control of the air current at the level of the plica nasi; the sphincter is composed of the lower cartilaginous vault and the caudal portion of the upper cartilaginous vault. Proetz pointed out that this is the one important element associated with the external nose that influences the direction, shape and the speed of inhaled air currents. It is located approximately 1 cm. above the external orifice. It is comparable to the nozzle of a hose "which directs the air stream upward; most of it passes through the olfactory fissure close to the septum and continues in a high arch to the face of the sphenoid bone and through the choanae to the pharynx."

Rhinoplastic surgical problems may be divided into four groups: (1) those of the osseous vault, which includes the perpendicular plate of the ethmoid and the frontal spine; (2) those of the upper cartilaginous vault with its quadrilateral cartilage; (3) those of the lower cartilaginous vault, and (4) those of the septum.

*Unusual Problems Arising in the Osse-*

Submitted for publication April 6, 1953.

*ous Vault.* — 1. *Absent Frontonasal Depression*: This frontonasal depression is one of the foundation points of the rhinoplastic procedure. After proper determination of its location, the septum should be separated from the pyramid with a chisel ventral osteotomy on both sides of the septum. The hump is then sawed thru at proper level. Then a chisel out fracture will remove the hump at proper level in two fragments.

2. *Excessive Frontonasal Depression*: A solution of this problem may require a cartilaginous implant.

3. *Insufficient Narrowing of the Osseous Vault*: After removal of a hump, the arch of the nasal pyramid must be restored and the side walls brought together to form the arch; otherwise the arch becomes flattened and the nose broad. To prevent postoperative broadening of the nose from ossification and reattachment along the line of osteotomy, it is advisable to dispose the cut edges of the lateral nasal walls within the maxilla. *Insufficient narrowing* in the presence of narrowing of the osseous vault may be due to one or more of the following causes.

a. Excessive thickness of the perpendicular plates of the ethmoid and nasal spine of the frontal. This is corrected by removing the part of the perpendicular plate located directly under the osseous vault—a cosmetic septectomy.

b. Incomplete fracture of the ascending process of the maxilla.

c. An excessively wide nasal root, which may be corrected by high osteotomy.

d. An excessively broad, poorly projected pyramid. This can be narrowed only by means of a dorsal graft. A broad, flat hump may make reformation of the nasal arch impossible after removal of the hump. In these circumstances, removal of the hump at a deep level and its replacement with a properly shaped graft are indicated.

4. *Dislocated or Curved Osseous Vault*: In a dislocated or curved nose with which there is difficulty in straightening and narrowing the osseous vault, the problem generally occurs because of a curvature at or below the junction of the perpendicular plate of the ethmoid or the nasal spine of the frontal with the pyramid. The osseous pyramid can be narrowed and brought into alignment only after septal reconstruction and final equalization of the lateral walls.

5. *Difficulty in Determining the Frontonasal Angle of the Nose and the Angle's Proper Projection of the Dorsum of the Nose in Cases of Excessively Projected or Recessed Nasal Tips*: Normally there are limitations to the amount of nasal dorsum to be removed. Regardless of the extent of the hump, sufficient portions of the lateral walls must be preserved to rebuild the arch. If the lateral walls do not meet after the hump is reduced, there will be a depression or saddling of the nose.

The extent to which the hump can be reduced is largely determined by the projection of the tip. A recessed tip may indicate removal of more of the hump; a noticeably projecting tip may demand more conservative removal. The projection of the tip depends on the nasolabial angle and on the projection of the nasal dorsum as determined by the frontonasal angle.

6. *Collapse of the Bony Vault into the Nasal Cavity*: This may occur when the lateral walls have been lowered too much, particularly when the bony vault is wide.

7. *Saddle Nose with Deficiency of Overlying Soft Structures*: After all indicated stages of the rhinoplasty have been performed, the graft should be implanted. The lack of nasal soft tissue covering or scarring may make the insertion of a graft of proper size impossible. However, a temporary graft may be employed, with the object of stretching the skin. When this has been accomplished, a permanent graft can be implanted. Incidentally, this is one rhinoplastic procedure which is indicated for children, as the presence of the graft makes the skin stretch and grow in both length and breadth.

a. The dorsum should be lowered sufficiently to allow for a single graft in preference to the use of several small grafts to

NAME S M D DATE

TELEPHONE OCCUPATION

ADDRESS RE BY: AGE

Chief Complaint:

History—

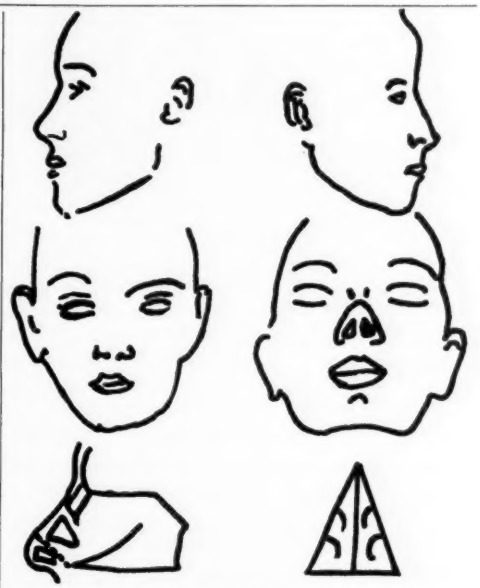


Fig. 1.—Patient's file card (see text).

| | |
|---|---|
| General Contour | |
| Forehead | |
| Frontonasal Depression | |
| Frontonasal Angle | |
| Septolabial Angle | |
| Nasolabial Angle | |
| Tip | |
| Columella | |
| Ala-Facial Fold | |
| Premaxilla | |
| Upper Lip | |
| Chin | |

| | LENGTH | WIDTH | CONFIGURATION AND PROJECTION | LOCATION | DEVELOPMENT AND FIRMNESS |
|---|---|---|---|---|---|
| Osseous Vault | | | | | |
| Upper Cart. Vault | | | | | |
| Lower Cart. Vault | | | | | |
| SEPTUM Ventral—Caudal | | | | | |
| Cephalic | | | | | |
| Dorsal—Ethmoid | | | | | |
| Vomer | | | | | |

| | |
|---|---|
| Nostrils | |
| Angle | |
| Ala | |
| Ala-Buecal Groove | |
| Nasolabial Junction | |
| Columella | |

Physical

Bleeding Time Coagulation Time Photographs

Fig. 2. — *A*, osseous vault with perpendicular plate of ethnoid. *B*, upper cartilaginous vault with quadrilateral cartilage. *C*, lower cartilaginous valut.

fill the depressions of the saddle nose.

b. If a dorsal and columella graft are necessary, two separate grafts are more desirable than a single angular graft.

c. Isogenous grafts are most desirable.

*Unusual Problems of the Upper Cartilaginous Vault.*—These will be discussed in conjunction with the septum.

III. *Unusual Problems of the Lower Laterals.*—Excessively poorly projecting or weakly developed lower laterals cannot tolerate the usual rhinoplastic procedures. Operation here may cause collapse at the ala.

Excessively overdeveloped lower lateral cartilages, when subjected to the usual surgical procedures, may cause unusual cartilaginous skin reattachments and new deformities.

If the deformity is largely cutaneous, or if it involves the subcutaneous tissues, lower lateral reconstruction does not solve the problem. Not all rhinoplastic procedures require operation on the lower cartilage vault.

Conditions not generally taken care of by the usual rhinoplastic procedures are as follows:

1. A receding premaxilla. This condition should be corrected before any columellar operation is performed. Premaxillarly implants should be placed into a properly fitting pocket. Premaxilla implants increase the projection of the lower cartilaginous vault.

2. An excessively short or excessively long columella. The length of the columella can be increased or decreased at the expense of the upper lip.

3. Problems of the tip. Different surgical procedures are necessary for each problem present:

a. Poorly developed or flabby lower laterals form a poorly projected tip. In these instances, it may be advisable to use a columella strut. Firm lower laterals reinforce the ventral weak spot.

b. A twisted tip may require columella or button type cartilaginous implants or caudal septal surgery.

c. If a short columella is responsible for retraction of the tip, correction can be achieved either by lengthening of the columella at the expense of the upper lip or in rare instances, placing a button type cartilaginous implant above the medial crura. This procedure may or may not be associated with lower cartilaginous surgery. A batton implanted to stretch the columella will not only be ineffective but will itself extrude.

4. Problems of the Nostril:

a. Excessively narrow or wide nares. The nares may be increased in size by thinning out the columella or decreased in size by pulling in the alae at the ala-facial fold.

b. Short, constricted nostrils. If this condition is present, one should not separate the medial from the lateral crus. The columella should be thinned out at its base and the tip projected with a button type of cartilaginous implant.

5. Shortening of the Nose. The slope of the nares determines to some extent the length of the nose. An upward tilt of 95 to 105 degrees is, as a rule, the most acceptable aesthetically. The general facial configuration dictates the amount of shortening. The long face with drooping lines lends itself to less shortening than does the round or broad countenance with

an upward slant of eyes and mouth. Consideration of the chin cannot be neglected in shortening the nose. A receding chin indicates a minimum of shortening; with a prominent chin, the procedure can be more extensive. Shortening of the external nasal pyramid should be done at the expense of the *lower* lateral cartilages. The upper lateral cartilages are cut to proper size at the end of the rhinoplasty, before any septal operation is performed. The vestibular membrane must be preserved in shortening the nose in order to prevent distortion of the nasal vestibule, which occurs with scar contracture due to a deficiency of this tissue. At the completion of the operation the nose should be of proper length without the benefit of septocolumella sutures.

a. *Thick Skinned Noses*: If the skin of the nose is thickened, shortening should be most conservative, in order to avoid piling up of the soft tissues with the formation of a low soft-tissue hump.

b. *Postoperative Dropping of the Tip*: Actually it is not the tip that drops; it is the entire lower cartilaginous vault. This may be avoided as follows:

1. Convert the lower vault into a flap by completely separating it from the upper cartilaginous vault at the limen vestibulae, the incision extending from the septum up to its pyriform margin.
2. After determining the proper septolabial angle and cutting the caudal end of the septum to its correct size, overcorrect this angle by further removing a very thin sliver from the septum; then denude its mucous membrane a few millimeters beyond its free margin.

*Unusual Problems of the Septum and the Upper Cartilaginous Vault.*—It is best that septal surgical intervention be performed after completion of the rhinoplastic procedure, when the location of the proper projection of the lower cartilaginous vault has already been determined and the septum and upper laterals have been cut to proper size. If an operation on the septum is performed before this, a caudal or caudocephalic twist of the septum that does not interfere with breathing may be converted into an obstructive one. A compensated septum has become decompensated.

When septal deflections are encountered in children, they should be corrected to restore the airway. Surgical intervention, however, should be minimal and very conservative. Operation should not be postponed, since deformity of the bony structures and inadequate functioning may result. A good general rule to follow in combined rhinoplastic and septal operations is as follows: Whatever reinforcement the upper laterals may give to the dorsum may be ignored if there is an excessively long bony vault and a fairly firm to firm lower cartilaginous vault.

Rhinoplastic procedures and submucous resections should be combined if possible. It is rare that such a combination detracts from either the cosmetic or the functional end results. It is true that minimal trauma and a superior healing process are achieved by operating in several stages. If a two-stage operation is indicated, the submucous resection is the first procedure, as it facilitates osteotomy and a more symmetric alignment of the nasal pyramid. A two-stage rhinoplasty is generally indicated when the external pyramid has a short osseous vault and a poorly developed or poorly supported lower cartilaginous vault associated with marked

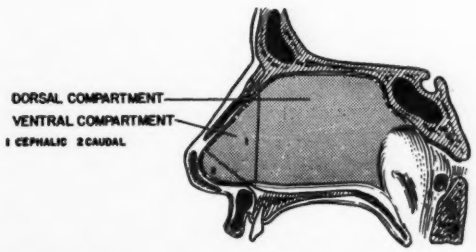



Fig. 3.—Component parts of septum (see text).

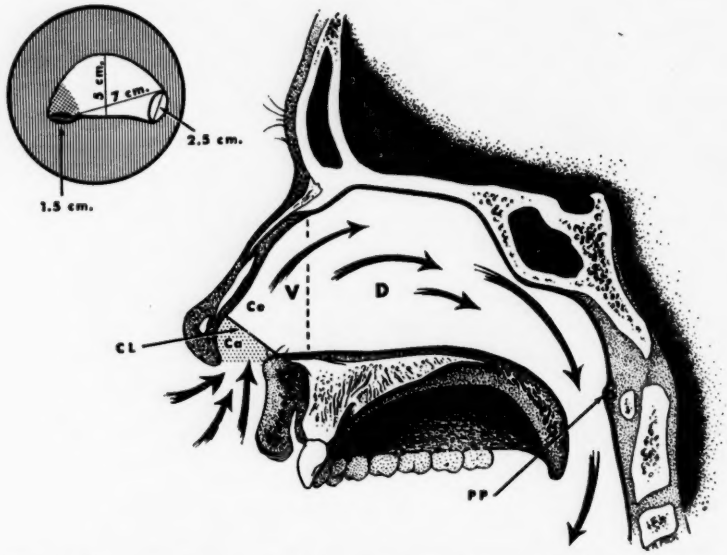



Fig. 4.—Diagram of nasal cavity, showing "bottleneck" in the air passageway. *V*, ventral compartment; *D*, dorsal compartment; *Ce*, cephalic part of ventral compartment; *Ca*, caudal part of ventral compartment; *CL*, critical line; *PP*, Passavant's pad.

to moderate ventral septal deformities that cause obstructed nasal breathing.

In performing a submucous resection the cartilage should be replaced between the membranes, particularly (a) in the presence of poorly developed lower laterals and a short osseous vault; (b) when the upper laterals swing away from the septum in such a manner as to create a large weak spot; (c) when there is danger of perforation; (d) when excessive trauma or lacerations of the membranes has occurred and excessive contracture of the membranes may occur, and (e) in the presence of redundant membranous tissue.

1. Problems of the dorsal compartment will not be discussed, because the usual septal procedures suffice.

2. Of ventral deviation problems there are three types: (a) caudal; (b) cephalic, and (c) caudocephalic. The caudal portion of the septum is separated from the cephalic portion by an imaginary line joining the weak spot to the maxillary spine.

a. In surgical correction of septal caudal deviations it is not advisable to sever the upper laterals from their septal attachments unless this juncture contributes to the twist of the nasal dorsum. In such cases, the twisted ventral margin of the septum should be removed submucously, without cutting that part of the mucoperichondrium which lines the septum and the under surfaces of the upper lateral cartilages. If the entire caudal end of the septum is to be removed, a cartilaginous implant of sufficient size is inserted between the septal membranes. Its purpose will be to project the lower cartilaginous vault and at the same time to permit its attachment to the nasal spine and to the upper laterals, which have been previously cut to proper size.

b. In cases of cephalic deviation the classic submucous resection is performed and the upper laterals

severed from their septal attachment. Frequently a twist in the bony septum will be transferred to the cartilaginous portion — having the same type of action as a spring. In these circumstances it is not advisable to cut the upper laterals from the septum until the bony portion of the deflection has been corrected.

c. In treating caudocephalic deviations one should avoid cutting the upper laterals from the septum and should follow the caudal septal surgical procedures previously discussed. If there is a twist at the juncture of the upper cartilages and the septum in the caudocephalic deflections, they should be cut submucously and the twisted cartilage removed and replaced by a straight piece of cartilage. (See Fig. 5). When there is a shift of the entire ventral compartment of the septum from the midline, associated with a shifting of the nasal pyramid in the same direction without any other twist in the septum (dislocation of the entire external pyramid and ventral compartment of the septum), the upper laterals may be separated from the septum as in a cephalic septal operation.

*Postoperative Problems.*—1. A successful cosmetic result will depend on the structures involved in the operation. Defects of the soft tissues are difficult to correct; cartilaginous malformations are

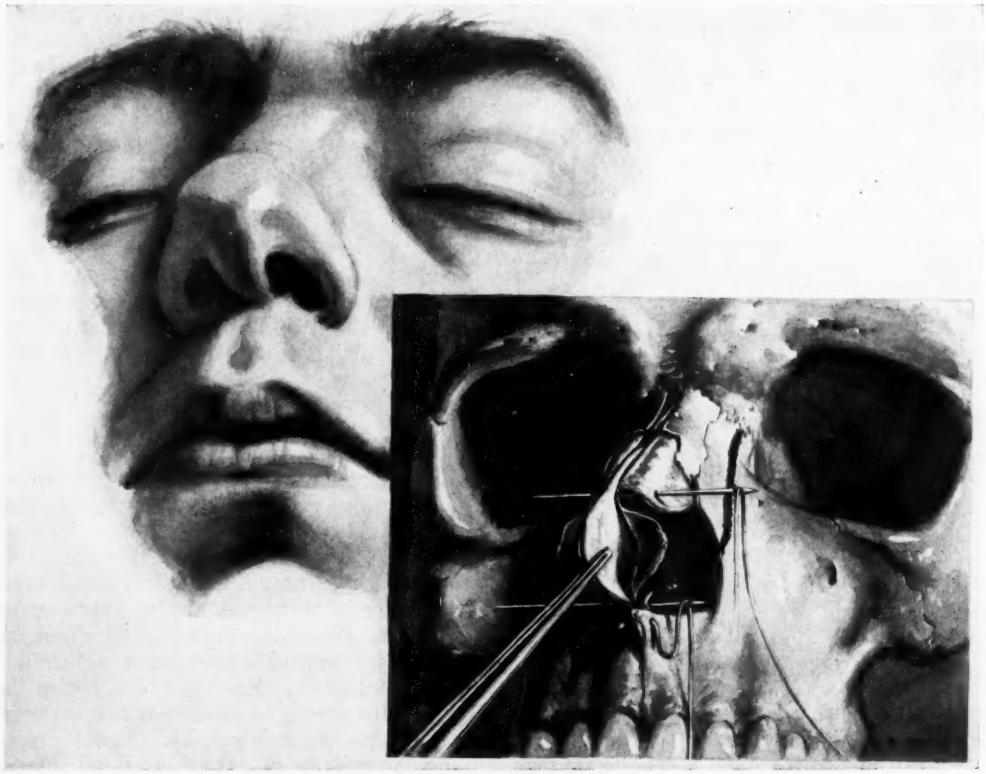


Fig. 5.—Operative technic (see text).

occasionally refractory to correction; deformities of the bony structures are the most amenable to reconstruction and give the most satisfactory results.

2. The operating surgeon must not depend on reparative processes and postoperative splinting to eliminate surgical errors. The least possible trauma at operation and a minimum of postoperative edema and ecchymosis insure the best results.

3. As has already been pointed out, function must not be sacrificed to the final appearance of the nose from the aesthetic point of view. Correction of flaring alae, for example, must not result in nares so narrow as to interfere with respiration.

4. The seborrheic skin is a detriment to the best cosmetic results, as it tends to heal with greater difficulty. It is associated with greater edema of the soft tissue and annoying dermatologic problems.

5. The necessity of revision is not an admission of lack of skill. Minor adjustments may be indicated in a certain percentage of rhinoplastic operations when the patient has had an abnormally poor postoperative wound reaction. In order to minimize the chances of need for revision in some cases, it is advisable that a fractional excess of hump be removed at the close of the operation in order to allow for the small amount of bone and cartilage that may be laid down in healing. The same is true of the caudal end of the septum, because postoperative reaction generally will cause a fractional increase in its size. At the close of the operation it is advisable to check the lateral osteotomy to make sure that bony fragments are well separated, for postoperative swelling may push them back into their original shape.

## SUMMARY AND CONCLUSIONS

Until recently, many rhinoplastic surgical problems and their solutions have been difficult to formulate. The basic procedures of rhinoplasty are well established, and the proper approach to these problems will be determined through the proper sharing of knowledge. The rhinologist is the specialist best equipped to handle rhinologic problems. In view of the fact that rhinoplasty is now an integral part of rhinology, it is essential that the rhinologist accept the responsibility of competent rhinoplastic surgery. By his training and his results, he is proving that he is capable and worthy of performing this type of surgical procedure.

## ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Viele Probleme der rhinoplastischen Chirurgie und ihre Lösungen liessen sich bis vor kurzem nur schwer formulieren. Die Grundlagen rhinoplastischer Verfahren sind festgelegt; der beste Weg, die noch bestehenden Probleme zu lösen, kann durch richtige Einteilung unserer Kenntnisse gefunden werden. Der Nasenarzt ist der Mann, der am besten in der Lage ist, rhinologische Probleme zu behandeln. Da die plastischen Nasenoperationen heute einen untrennbaren Bestandteil der Nasenheilkunde darstellen, ist es ausserordentlich wichtig, dass der Nasenarzt bereit ist, die Verantwortlichkeiten eines qualifizierten Nasenplastikers zu übernehmen. Er muss auf Grund seiner Ausbildung und durch seine Erfolge beweisen, dass er fähig und berechtigt ist, diese Form chirurgischer Operationen auszuführen.

## RESUMEN Y CONCLUSIONES

Hasta recientemente, muchos problemas rinoplásticos y sus soluciones eran difíciles de formular. Los procedimientos básicos de rinoplastía estan bien establecidos y la forma de abordar estos problemas será determinada a traves de la distribución adecuada del conocimiento. El rinólogo esta mejor equipado para manejar problemas rinológicos. En vista del hecho de que la rinoplastía es actualmente una parte integral de la rinología, es esencial que el rinólogo acepte la responsabilidad de un competente cirujano rinoplástico. Por

medio de este entrenamiento y sus resultados, el esta probando qque es capaz y merece la práctica de este tipo de procedimiento quirúrgico.

RÉSUMÉ ET CONCLUSIONS

Jusqu'a ces derniéres années, maints problèmes de chirurgie rhinoplastique n'ont pas trouvé de solution satisfaisante. C'est pourquoi l'auteur expose les procédés de rhinoplastie avec clarté et souligne les connaissances que le rhinologiste doit posséder pour faire cette chirurgie. S'il veut prendre la responsabilité d'une rhinoplastie, il ne doit pas être seulement spécialiste, mais il faut que ses connaissances s'étendent à la chirurgie générale. Il arrivera ainsi, par son entraînement et les résultats qu'il obtient, à prouver qu'il est un spécialiste digne de ce nom.

RESUMO

Até bem pouco tempo a cirurgia plástica do narís apresentava problêmas e soluções dificeis de sêreh resolvidos. Agora os processos basicos da rinoplastia estão bem estabelecidos, mercê de um melhor conhecimento, sendo o rinologista o melhor especialista capacitado a resolver tais problêmas, e, como tal, o rinologista deve assumir a responsabilidade de conhecimentos e de experiencia da rinoplastia. Pelo seu treinamento e pelos resultados por êle obtidos, estará em perfeitas condições de proceder êsse interessante tipo de cirurgia.

CONCLUSIONI RIASSUNTIVE

Fino ad ora molti problemi della chirurgia rinoplastica presentavano difficili soluzioni, ma ora sono state poste le basi della rinoplastica e i problemi relativi vengono risolti sulla base di conoscenze organiche. Gli specialisti rinologi sono ben attrezzati e in grado, con la collaborazione di chirurghi allenati, di eseguire gli interventi di plastica del naso.

BIBLIOGRAPHY

Proetz, A. W.: Physiology of the Nose from the Standpoint of the Plastic Surgeon, Arch. Otolaryngol. 39:514-517 (June) 1944.

The highest compact we can make with our fellow is: Let there be truth between us two forevermore. . . . It is sublime to feel and say of another, I need never meet, or speak, or write to him; we need not reinforce ourselves or send tokens of remembrance; I rely on him as on myself; if he did thus or thus, I know it was right.

—*Emerson*

# Effect of Intravenous Procaine on Anuria and Oliguria Associated with the Toxemias of Pregnancy

MILTON J. SERWER, A.B., M.D., F.I.C.S.

OKLAHOMA CITY, OKLAHOMA

TREATMENT of the toxemia of pregnancy, especially eclampsia, is highly controversial and varies from no treatment to drastic measures of many types. In reviewing the various methods used, one is impressed with the poor results frequently obtained in the presence of severe oliguaria or anuria. This paper will be concerned primarily with this particular phase of the treatment of toxemia of pregnancy.

Beker expressed the opinion that toxemia of pregnancy is secondary to arteriolar spasm. In the kidney this is confined primarily to the lower nephron and to some degree to the glomerulus. As a result of this spasm and decrease in blood supply, necrosis of the distal tubule of the kidney results. After this the tubule loses its power of selective reabsorption or rejection of glomerular filtrate and, as a result, reabsorbs passively the entire glomerular filtrate. In Mauzy's opinion, the pathologic process in the tubule in the early stages is reversible to the extent that repair may become complete.

With the concept in mind that the anuria is secondary to an arteriolar spasm in the kidney, primarily in the region of the lower nephron, the problem then resolved itself into an attempt to find a suitable vasodilator which would improve blood flow and so allow the tubule to regenerate, if the pathologic process were not too far advanced.

Many of the diuretic substances previously used were reconsidered. Among the first was hypertonic dextrose. From the work of Bradbury and Brown, who have evaluated many diuretics used for the toxemias, it was concluded that hypertonic dextrose is not a true diuretic but merely filters fluid passively, since the amount of urine obtained was always less than the amount of fluid given. It has also been shown that with hypertonic glucose the patient is placed in a state of positive nitrogen balance.

Later work by Stern has shown that with hypotonic dextrose (5 per cent) given intravenously, the patient was placed in a state of negative nitrogen balance and the body would more readily excrete the hypotonic than the hypertonic dextrose solution. Ammonium chloride, though effective for a limited time, has the disadvantage of having to be given orally, which is not feasible with comatose patients. In an attempt to find a substance that might conceivably restore the physiologic function of the kidney, so as to allow for normal diuresis, procaine was considered.

The intravenous administration of procaine has been used for years (Bier, 1909) in treatment of the various conditions involving pronounced spasm of smooth muscle (Isenberger, Rovenstine, Estes, Griffrida). Hatcher and Eggleston have shown that 95 per cent is detoxified by acetylation in the liver within twenty minutes. Fosdick and Hanson and Legge and Durie stated that it is broken down to para-aminobenzoic acid and diethyl-aminoethanol. The drug has no cumulative effect. Six to ten

Read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.
Sumbitted for publication Oct. 19, 1953.

Gm. has been given intravenously in twenty-four hours without evidence of damage to the liver. The injection of the metabolites does not produce the same effect as does the procaine itself. In animals the toxic dose of procaine given intravenously rapidly is stated as 50 mg. per kilogram of body weight.

Sensitivity to procaine given intravenously is rare according to Graubard and Peterson, who used it over 4,000 times without serious reactions. They stated that nervous side reactions are readily controlled with the barbiturates, and respiratory embarrassment with epinephrine. On the basis of this reasoning, procaine might be helpful in relaxing smooth muscle spasm, including the vascular system of the kidneys, and thus promote regeneration of the kidney tubular epithelium and improvement in its function.

Rodriguez reported on the use of procaine intravenously in 1 case of eclampsia complicated by anuria with a good result.

For the purposes of this study (Table 1) patients with toxemia were selected who had been previously treated by others and myself with the usual routine methods used at that particular hospital at that time. After it was decided that the method used was of no avail, that the patient was becoming progressively worse and severely oliguric or anuric, procaine was administered. The average dose used was 500 mg. dissolved in 500 cc. of dextrose in water (5 per cent). This was changed later to 500 mg. of procaine dissolved in 200 cc. of dextrose in water (5 per cent). Owing to the rapid metabolism of the drug, it was given intravenously through an 18-gauge needle as rapidly as it could be introduced, the entire amount being given in about eight to ten minutes. This was repeated as often as every four hours, for periods as long as forty-eight hours, or until such time as it was considered that diuresis was well established and could be controlled without procaine. In instances in which the patient was not heavily sedated it was noted that the drug caused apprehension, which would subside spontaneously after about ten minutes. Because of this, and the further necessity of deep sedation to control convulsions, the administration of the procaine was preceded by sedation. It has been demonstrated by Hanely and Keller, Kraushaar, and his co-workers, and Brown that morphine sulphate has an antidiuretic effect through its action on the pituitary gland. On 2 occasions, after diuresis had been established and stablized, morphine sulfate was given to determine this effect. Within thirty minutes the urinary output was decreased by about 50 per cent. This was true likewise of the barbiturates, but to a much less degree. After trial of various barbiturates, the best results were obtained with sodium amytal given intravenously. The drug was given to the stage of deep sleep, the dose varying from 0.5 to 1.5 Gm. It was repeated as indicated. In short, the amount sufficient to obtain adequate sedation was given.

After administration of the drug there was an apparently latent period varying from two to twelve hours, before the appearance of urine. This could be tentatively ascribed to the time required to cause sufficient regeneration in the tubular epithelium to permit normal physiologic function of the tubules.

In an attempt to determine the onset of activity of the drug on the vascular system, the eyegrounds were examined by a member of the ophthalmology department (Dr. Tullos Coston). Within three to five minutes after administration of the drug there was marked dilatation of the retinal vessels. It could be assumed that the same situation was present in the arterioles of the kidney.

The blood pressure dropped slightly after administration of procaine, occurring only after diuresis has been established and the patient well stabilized. A possible explanation is the statement by Sollman (citing Hatcher and Eggleston) that intravenous administration of procaine causes cardiac stimulation, which tends to counteract the effect of the vasodilatation.

Whitacre has stated that in the presence of preeclampsia and eclampsia there is

TABLE 1.—*Data on Patients Treated with Intravenous Procaine*

| *Patient* | *Complication of Pregnancy* | *Output of Urine* | *Procaine, Units** | *Onset of Diuresis, Hours* | *Urine Excreted, Cc.* | *Blood Pressure Before Procaine* | *Blood Pressure After Procaine* | *Delivery* | *Result* |
|---|---|---|---|---|---|---|---|---|---|
| R.M. | Antepartum eclampsia; | 4 cc. /hr. for 12 hr. | 3 | 3 | 400/3 hr. | 180/110 | 160/100 | Vaginal | Good |
| I.L.W. | Antepartum eclampsia; essential hypertension; glomerular nephritis | 200 cc./24 hr. | 3 | 6 | 1,200/24 hr. | 240/150 | 200/125 | Vaginal | Fair |
| E.M.D. | Postpartum eclampsia | 24 cc./2 hr. | 5 | 2 | 104/hr. | 190/120 | 140/100 | Vaginal | Good |
| L.L.B. | Chronic glomerular nephritis | 300 cc./24 hr. | 6 | — | 300/24 hr. | 260/160 | 260/160 | Vaginal | Death 30 days after |
| W.P. | Antepartum eclampsia | Anuria 6 hr. | 5 | 6 | 4,000/24 hr. | 150/115 | 130/95 | Vaginal | Good |
| M.E.B. | Antepartum eclampsia | Anuria post partum | 2 | 6 | 4,350/24 hr. | 120/70 | 160/100 | Vaginal | Good |
| M.V. | Pre-eclampsia | 8 hr. 300 cc./24 hr. | 4 | — | 900/8 hr. | 130/108 | 120/95 | Vaginal | Fair; nephritis with next pregnancy |
| R.L.J. | Antepartum eclampsia | Postpartum anuria 8 hr. | 2 | 6 | 2,460/24 hr. | 150/110 | 130/85 | Vaginal | Good |
| C.McC. | Postpartum eclampsia; hemorrhage | Anuria 6 hr. | 7 | 0 | 0 | 140/90 | 130/70 | Vaginal | Death from cerebral hemorrhage |
| E.H. | Antepartum eclampsia | 35 cc./24 hr. | 2 | 6 | — | 180/110 | 140/90 | Vaginal | Good |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| N.G. | Infectious hepatitis; eclampsia 7 mo. | 35 cc./24 hr. | 2 | 0 | 52/8 hr. | 200/130 | 190/120 | Cesarean | Death |
| M.McC. | Antepartum eclampsia | 170 cc./24 hr. | 3 | 4 | 170/8 hr.<br>1,096/24 hr. | 210/120 | 162/168 | Vaginal | Good |
| M.McK. | Pre-eclampsia | 360 cc./24 hr. postpartum | 2 | 6 | 1200/8 hr. | 150/110 | 130/90 | Vaginal | Good |
| V.M. | Antepartum eclampsia | Anuria 4 hr. | 10 | 8 | 469/24 hr.<br>1,779/24 hr.<br>2,500/24 hr. | 180/140 | 160/120 | Vaginal | Good |
| C.B. | Antepartum eclampsia | 60 cc. 6 hr. postpartum | 7 | 8 | 2,000/24 hr. | 146/118 | 130/90 | Vaginal | Good |
| L.B. | Antepartum eclampsia, 6½ mo. | Anuria 6 hr. | 3 | 4 | 200/4 hr. | 168/118 | 150/100 | Vaginal | Good |
| W.H.S. | Pre-eclampsia; postpartum eclampsia | 86 cc./24 hr. postpartum | 2 | 6 | 530/4 hr.<br>8,627/24 hr. | 134/97 | 140/110 | Vaginal | Good |
| E.J.W. | Antepartum eclampsia | Anuria 6 hr. | 6 | 12 | 300/24 hr. | 170/90 | 170/90 | Vaginal | Fair; improved after delivery |
| G.R.A. | Postpartum eclampsia | Anuria 4-48 hr. postpartum | 8 | 6 | 800/24 hr.<br>1,800/24 hr. | 200/100 | 130/80 | Vaginal | Good |
| B.S.C. | Antepartum eclampsia; essential hypertension; chronic nephritis | 320 cc./24 hr. | 15 | — | 1,222/24 hr.<br>72 hr. later | 285/210 | 164/110 | Vaginal | Good |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L.R. | Antepartum eclampsia | 15 cc./hr. | 4 | 12 | 625/24 hr.<br>2,000/24 hr. | 158/98 | 130/90 | Vaginal | Good |
| B.J.B. | Antepartum eclampsia | Anuria 6 hr. | 3 | 8 | 2,200/24 hr. | 160/124 | 130/90 | Vaginal | Good |
| B.S. | Antepartum eclampsia | 10 cc./hr. | 2 | 6 | 1,500/24 hr. | 130/90 | 100/70 | Vaginal | Good |
| J.B. | Antepartum eclampsia; essential hypertension; chronic glomerular nephritis | 20 cc./4 hr. | 4 | 8 | 500/24 hr. | 200/154 | 190/146 | Cesarean | Poor |
| F.D. | Antepartum eclampsia | 47 cc./9 hr. | 5 | 0 | 0 | 170/100 | 180/120 | Vaginal | Poor (death) |
| H.H. | Antepartum eclampsia; abruptio placentae; cardiac decompensation | Anuria 10 hr. | 2 | 8 | 2,310/24 hr. | 200/100 | 190/110 | Vaginal | Good |
| R.G. | Pre-eclampsia; abruptio placentae | Anuria 48 hr. postpartum | 2 | 4 | 300/24 hr. | 180/110 | 180/110 | Cesarean | Good |
| E.P.<br>F.K. | Antepartum eclampsia | Anuria 72 hr. | 3 | 13 | 500/24 hr.<br>3,300/24 hr. | 200/140 | 180/120 | Cesarean | Good |
| No. 1 tap | Antepartum eclampsia | Anuria | 3 | 6 | 1,000/24 hr. | | | | Good |
| No. 2 tap | Abruptio placentae | Oliguria | | | Data not available | | | | Good |
| No. 3 tap | Acute yellow atrophy | | | | | | | | Poor (death) |

*500 mg. in 200 per cent dextrose (5 per cent).

hydration of the extracellular compartment, with dehydration of the intravascular compartment. On this basis he suggested using large amounts of dextrose in water (5 per cent), since it has been observed that the latter is not readily retained and results in a negative nitrogen balance. Later in the series, intravenous administration of procaine was followed by administration of dextrose (5 per cent) given intravenously at the usual rate of flow. The patients' lungs were checked carefully to determine whether passive congestion was developing. This was not found to be the case. With this additional procedure, diuresis and subsequent improvement of the patient were enhanced.

Three patients had persistent anuria following intravenous administration of procaine (L. L. B., N. G., F. D.) and died (Table 2). The first 2 had organic kidney disease in which arteriolar spasm was of minor importance. A good result was not to be expected. The deaths were recorded as due to chronic glomerulonephritis (L. L. B.) and infectious hepatitis (N. G.). The condition of the third patient (F. D.) was diagnosed as eclampsia with respiratory failure. A good result was to be expected had not the respiratory failure supervened.

TABLE 2.—*Statistical Tabulation*

| | |
|---|---|
| Number of patients with anuria | 12 |
| Duration of anuria (hours) | 4 to 72 |
| Average (hours) | 18.3 |
| Mean (hours) | 6 |
| Number of patients with oliguria (Less than 350 cc. in 24 hours) | 17 |
| Number of patients with persistent anuria. | 3 |
| Average amount of procaine; each transfusion | 500 Mg. |
| Number of infusions, each patient | 2 to 15 |
| Average | 4.5 |
| Mean | 3.5 |
| Onset of diuresis (hours) | 2 to 13 |
| Average | 6.8 |
| Mean | 6 |
| Average change in blood pressure after procaine | |
| Systolic | —25.9 |
| Diastolic | —20.7 |
| Extremes | |
| Systolic | + 40 to —121 |
| Diastolic | + 48 to —100 |

TABLE 3.—*Analysis of Failures*

| | |
|---|---|
| *Fair result* | |
| *Antepartum eclampsia (E.J.W.) | 1 |
| *Severe pre-eclampsia (M.V.) | 1 |
| Eclampsia, essential hypertension and chronic glomerulonephritis (B.S.G., I.L.W.) | 2 |
| Total | 4 |
| *Poor result* | |
| Chronic glomerulonephritis (L.L.B.) | 1 |
| Eclampsia, essential hypertension, chronic glomerulonephritis (J.B.) | 1 |
| *Eclampsia, cerebral hemorrhage (C.McC.) | 1 |
| Infectious hepatitis (N.G.) | 1 |
| Acute yellow atrophy (Tap) | 1 |
| *Eclampsia, cerebral edema with respiratory failure (F.D.) | 1 |
| Total | 6 |
| Total number of failures | 10 |
| *Good results anticipated but not obtained. | 4 |
| Improvement not anticipated | 6 |

Table 3 lists the fair and poor results. A fair result was considered one in which (a) the urinary output was increased moderately (B. S. G., I. L. W., M. V.), and/or (b) delivery occurred in the interval, so that continued improvement due to the procaine could not be evaluated (E. J. W.). A poor result was considered one in which (a) the anuria was not relieved, so that the pregnancy had to be terminated (J. B.), or (b) death followed (L. L. B., C. Mc. C., N. G., F. F., No. 3 tap).

After the toxemia had become stabilized, termination of the pregnancy was advised. Three patients (V. M., R. G. and E. P.) who underwent cesarean section for obstetric indications, were given intravenous procaine during the delivery and the first day post partum. The output of urine remained adequate, and recovery was uneventful. Two patients (J. B. and N. G.) in whom the result with intravenous procaine was poor, were delivered by cesarean section. One patient (J. B.), who had essential hypertension, chronic nephritis and eclampsia, recovered; the other (N. G.), who had infectious hepatitis and eclampsia, died.

REPORT OF CASES

CASE 1.—V. M., aged 25, para 1, gravida 2, was admitted to the hospital on Jan. 28, 1951, at 4:30 a.m. She was 36 weeks pregnant. Her past history was normal. Her mother stated that the pregnancy had been normal until one week before the patient's admission to the hospital, at which time symptoms developed that were ascribed by the attending physician to eclampsia. The mother stated also that for the past twelve hours the patient had complained of severe headache, had been disoriented and had had three convulsions.

On admission, generalized edema was observed. The blood pressure in millimeters of mercury was 188 systolic and 140 diastolic. At 7:10 a.m. the patient had a convulsion. She was given sodium luminal intramuscularly and sodium pentothal intravenously. A retention catheter was placed in the bladder. No excretion of urine had been noted six hours after the patient's admission.

Twenty per cent dextrose (1,000 cc. in water) had been administered intravenously at the time of admission. The patient remained anuric. Five hundred mg. of procaine hydrochloride in 200 cc. of 20 per cent dextrose in water was given intravenously and continued at four-hour intervals. The total intake of fluid in the next twenty-four hours was 1,000 cc. The total output of urine in the next twenty-four hours was 469 cc.

On January 30 the administration of procaine was followed by intravenous administration of 5 per cent dextrose in water. The total intake of fluid in the next twenty-four hours was 2,500 cc. and the output of urine 1,779 cc. The average blood pressure was 190 systolic and 144 diastolic. The value for nonprotein nitrogen was 30 mg., that for serum protein 4.9 mg., and that for uric acid 6.3 mg., per hundred cubic centimeters. The albumin-globulin ratio was 0.96:1.

On February 1 the total intake of fluid in twenty-four hours was 1,500 cc. and the urinary output 2,100 cc. The average blood pressure was 160 systolic and 132 diastolic.

Since the output of urine was improved and the patient stabilized, induction of labor was decided upon. Fractional doses of pituitrin were given, with no result. Delivery was then accomplished by cesarean section. Procaine hydrochloride, given intravenously, was continued during the operation and for the first twenty-four hours post partum.

On February 3 the patient was rational. The total intake of fluid in twenty-four hours was 3,335 cc. and the output of urine 3,842 cc.

On February 5 the value for nonprotein nitrogen was 28 mg., and that for uric acid 4.2 mg., per hundred cubic centimeters. There was a trace of protein in the urine.

On February 10, since the patient's course had remained satisfactory during the past week, she was discharged from the hospital.

The result obtained by the use of procaine was considered good.

*Comment.* — In this case antepartum eclampsia was complicated by anuria. After the administration of intravenous procaine, diuresis was established and the toxemia stabilized. Delivery was accomplished by cesarean section on the basis of an obstetrical indication. Intravenous administration of procaine was continued during the operation and for twenty-four hours post partum. The output of urine remained adequate, and the subsequent course was uneventful.

CASE 2.—H. H., aged 40, para 2, gravida 3, was admitted to the hospital on Oct. 3, 1949. She had had normal pregnancies in 1924 and 1943. Rheumatic heart disease had been present for many years, with decompensation during the past year. She stated that she was taking digitalis regularly.

Physical examination showed the patient to have rheumatic heart disease, with early decompensation, and pregnancy of 38 weeks' duration.

On October 4, at 3 a.m., the patient had a convulsion. The blood pressure in millimeters of mercury was 250 systolic and 136 diastolic. The output of urine averaged 75 cc. in four hours.

The diagnosis was eclampsia, abruptio placentae and rheumatic heart disease with decompensation. The patient was treated with morphine, dilaudid, intramuscular sodium luminal, intravenous dextrose in water (20 per cent), intravenous dextrose in water (50 per cent) and oxygen. At 5:30 a.m. she had a convulsion. At this time the bag of waters ruptured spontaneously. The uterus was tense, and the output of urine dropped to 15 cc. per hour. Rectal examination showed the cervix to be 5 cm. dilated. The fetal heart rate was 140.

The patient's condition was considered

critical, and preparations were made for a postmortem cesarean section. On October 5, at 3 a.m. a living fetus was delivered spontaneously. For fifteen hours after delivery the patient remained anuric. At 6:30 p.m., 500 mg. of procaine hydrochloride in 200 cc. of dextrose in water (5 per cent) was given intravenously. This was repeated in about six hours. Approximately six hours after the first infusion the output of urine began. The total for the next twelve hours was 910 cc., and for the second twelve hours 500 cc. Dextrose in water (5 per cent), administered intravenously, was continued thereafter.

On October 7, the output of urine was 2,600 cc., and on October 8, 2,800 cc., per twenty-four hours. The blood pressure at this time was 210 systolic and 86 diastolic.

On October 9 the output of urine was 2,300 cc. per twenty-four hours. The blood pressure at this time was 190 systolic and 90 diastolic. From this time on the patient was rational, and the subsequent postpartum course was uneventful. On October 17 there was a trace of protein in the urine. On October 22 the patient was discharged, much improved.

The result of procaine therapy was considered good.

*Comment.*—In this case eclampsia was present, with anuria, complicated by cardiac decompensation. Neither condition could be considered benefited by the delivery, since the onset of the anuria occurred post partum and the decompensation likewise became aggravated after adequate digitalis therapy.

CASE 3.—J. B., para 0, gravida 1, had had a questionable infection of the urinary tract in childhood. After twenty-six weeks of the present pregnancy the attending physician noted symptoms of toxemia for the first time. After treatment the patient lost 20 pounds (9.1 Kg.) in weight in ten days. On Nov. 6, 1952, approximately five weeks later, the physician noted symptoms of recurrence of the toxemia. A relative stated that the patient's vision on that day had been blurred, that she seemed mentally confused and that she had an attack of unconsciousness.

The patient was admitted to the hospital on November 19. The admission note stated that she seemed mentally confused and complained of blurred vision. The blood pressure in millimeters of mercury was 178 systolic and 138 diastolic. There was generalized edema. Retinal spasm was observed, with hemorrhages. The height of the uterine fundus indicated pregnancy of about 36 weeks' duration.

The value for blood nonprotein nitrogen was 35 mg., and that for uric acid 3.1 mg., per hundred cubic centimeters. The albumin-globulin ratio was 2.6:2.3.

For the next twenty-four hours the patient's condition remained unchanged. Dextrose in water (20 per cent) was administered intravenously. The attending physician advised induction of labor by amniotomy.

On November 21 there was no evidence of labor. The output of urine averaged 1,500 cc. per hour. At this time 500 mg. of procaine hydrochloride in 200 cc. of dextrose in water (5 per cent) was given intravenously twice, with a four-hour interval. After twelve hours there was no increase in the output of urine. Upon recommendation of the staff attendant, cesarean section was done.

On November 22, the total intake of fluid per twenty-four hours was 1,500 cc. and the output of urine 1,500 cc. The patient continued to improve. On November 28 chemical tests of the blood chemistry revealed the value for sodium to be 122 milliequivalents and that for potassium 4 milliequivalents. The carbon dioxide combining power was 26.5. The urine showed a trace of protein. The result of procaine therapy was considered poor.

*Comment.*—This case illustrates antepartum eclampsia complicated by anuria. The output of urine, which averaged 15 cc. per hour, did not improve twelve hours after procaine had been administered. The attending physician elected to terminate the pregnancy by cesarean section. Since the improvement in the toxemia might be attributed to the delivery, the result of the administration of intravenous procaine was considered poor.

CASE 4.—F. D., para 1, gravida 2, had a normal medical history. The history of the present pregnancy was supplied by a relative. The patient had had no previous prenatal care. She had gained about eight to ten pounds (3.6 to 4.1 Kg.) during the course of pregnancy. One week prior to admission she had complained of headaches of increasing severity and had noticed increasing generalized edema. She had had two convulsions on the day before admission to the hospital. The last menstrual period was unknown, but was

estimated as due in December 1952.

On physical examination, generalized edema was noted. The uterus measured 35 cm. (McDonald). The fetal heart rate was 154; the blood pressure in millimeters of mercury was 140 systolic and 100 diastolic. The value for nonprotein nitrogen was 22.2 mg., that for uric acid 3.7 milliequivalents, that for serum protein 4.7 Gm., and that for albumin 3.2 Gm., per hundred cubic centimeters of blood. The carbon dioxide combining power was 18.2. There was a 4 plus reaction for proteinuria.

The patient was given sedation; oxygen was administered intranasally. A total of 4,000 cc. of dextrose in water (5 per cent) was administered intravenously during the next twenty-four hours. The output of urine after the first twenty-four hours was 500 cc.

On Oct. 24, 1953 the blood pressure was 210 systolic and 140 diastolic. Anuria had been present for the past seven hours. Examination of the spinal fluid showed 108 mg. of protein per hundred cubic centimeters. At 2 p.m., a note was made that the patient was "wild." Sodium amytal was given intravenously for sedation. At 3 p.m. the patient had a sudden complete respiratory arrest and was placed in the respirator shortly thereafter. The impression of the neurosurgeon was that of a cerebral vascular accident.

Five hundred mg. of procaine hydrochloride given intravenously in 200 cc. of dextrose every twelve hours was continued for three doses. For the next twenty-four hours the output of urine was 150 cc. At 7 p.m. the patient delivered a dead child. After delivery the anuria persisted.

On October 25 the respiratory arrest and anuria persisted. Laboratory examination revealed the following values: sodium 118 milliequivalents, potassium 4 milliequivalents, carbon dioxide combining power 23.4 uric acid 2.4 milliequivalents, and nonprotein nitrogen 37 mg. per hundred cubic centimeters.

On October 26 the patient died. The autopsy report revealed (1) cerebral edema, with moderate pressure cone of the cerebellum, (2) parenchymatous degeneration of the kidneys; (3) atelectasis, emphysema, and acute passive congestion of the lungs, and (4) a normal liver.

The result of procaine therapy was considered poor.

*Comment.*—A case of antepartum eclampsia complicated by anuria and respiratory arrest and ending in death is reported. Neither the administration of intravenous procaine nor the delivery affected the outcome. Autopsy showed marked cerebral edema, a pressure cone of the cerebellum being the cause of respiratory failure and death. The administration of intravenous procaine did not affect the outcome, and the result was considered poor.

TABLE 4.—*Summary of Results*

| | No. of Patients |
|---|---|
| Good results | 21 |
| Fair results | 4 |
| Poor results | 6 |
| Total | 31 |

*Summary of Results*
(Corrected)

| | | No. of Patients |
|---|---|---|
| Good results | | 21 |
| Fair results | 4 | |
| Improvement not anticipated | 2 | |
| Corrected fair results | | 2 |
| Poor results | 6 | |
| Improvement not anticipated | 4 | |
| Corrected poor results | | 2 |
| Total (corrected) | | 25 |

## SUMMARY AND CONCLUSIONS

Thirty-one patients with toxemia of pregnancy complicated by severe oliguria or anuria were treated with procaine given intravenously. Good results were obtained with 21, fair results with 4 (corrected 2), and poor results with 6 (corrected 2).

The average duration of anuria was eighteen and three-tenths hours, the mean, six hours. The average amount of procaine used was 500 mg. in 200 cc. of 5 per cent dextrose in water given intravenously. The average interval between the administration of procaine and the onset of diuresis was six and eight-tenths hours; the mean, six hours.

Since procaine is rapidly metabolized, the fluid was administered in eight to ten minutes. The administration of procaine is followed by apprehension and should be

preceded by adequate sedation, preferably a barbiturate (sodium amytal given intravenously). A drop in blood pressure occurs only after diuresis has been well established.

The author concludes that, although intravenous procaine has no value in the treatment of organic disease of the kidneys, it is a valuable adjunct to the treatment of severe oliguria or anuria associated with the toxemias of pregnancy.


RESUMO E CONCLUSOES

Trinta e um casos de toxemia gravidica complicados por grave oliguria ou anuria foram tratados com injeções intra-venosas de procaina.

Goram obtidos bons resultados em 21 doentes, resultados regulares em 4, e pouco sucesso em 6. O tempo medio da anuria various entre 18 e 36 horas, sendo a mais baixa de 6 horas.

Foram usados cêrca de 500 mgrs. de Procaina em 200 cc. de solução de Glicose a 5%, obtendo-se os resultados entre 6 e 8 e 10 horas; a mais baixa foi de 6 horas.

Desde que a Procaina é rapidamente metabolisada, o liquado é injectado entre 8 e 10 minutos, devendo se tomar a precaução de sedar a doente previamente, dando os autôres preferencia aos barbituricos (amital sedico por via venosa).

ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

In 31 Fällen von mit schwerer Oligurie oder Anurie einhergehender Schwangerschaftsoxikose wurde eine Behandlung mit intravenöser Verabreichung von Prokain durchgeführt.

Die Erfolge waren in 21 Fällen gut, in 4 Fällen mässig und in 6 Fällen schlecht. Die Dauer der Harnverhaltung betrug durchschnittlich 18 Stunden und 18 Minuten, im arithmetischen Mittel 6 Stunden. Die angewandte Menge von Prokain war durchschnittlich 500 mg in 200 ccm fünfprozentiger Dextroselösung. Die Zeitspanne zwischen der intravenösen Verabfolgung des Prokains und dem Einsetzen der Diurese betrug durchschnittlich sechs Stunden und 48 Minuten, im arithmetischen Mittel 6 Stunden.

Da das Prokain sehr rasch metabolisiert wird, erfolgte die Einspritzung innerhalb von 8 bis 10 Minuten. Im Anschluss an die Verabreichung von Prokain kommt es zu einem Erregungszustand, und daher sollte der Einspritzung eine angemessene Behandlung mit Beruhigungsmitteln, am besten mit Barbitursäuresalzen (intravenöse Injektion von Amytalnatrium) vorangehen. Ein Absinken des Blutdrucks erfolgt erst, wenn eine gute Harnausscheidung eingesetzt hat.

Die intravenöse Prokainbehandlung ist nutzlos in Fällen von organischer Nierenkrankheit; bei schwerer Harnverhaltung in Fällen von Schwangerschaftstoxikose jedoch erweist sie sich als wertvolles Verfahren.

RESUMEN Y CONCLUSIONES

Se trataron con procaína intravenosa 31 pacientes con toxemia del embarazo que presentaban oliguria ó anuria.

Se obtuvieron buenos resultados en 21, regulares en 4 (2 corregidos) y malos en 6 (2 corregidos). El promedio de duración de la anuria fué de dieciocho y tres cuartos de hora, con una media de seis horas. La cantidad promedio de procaína usada fué 500 mg., en 200 cc. de solución de dextrosa al 5 por ciento, administrada intravenosamente. El intervalo promedio entre la administración de procaína y el comienzo de la diurésis fué de seis y ocho decimos de hora con una media de seis horas.

Ya que la procaína se metaboliza rápidamente, debe administrarse líquido en ocho a diez minutos. La administración de procaína es seguida de nerviosidad y debe ser precedida por una cantidad adecuada para sedar al paciente, preferiblemente por un barbiturato (amital sódico intravenoso). Unicamente después de que la diurésis ha comenzado se produce una caída de la presión arterial.

La procaína intravenosa no tiene valor en los casos de padecimiento orgánico del riñón pero es un coadyuvante de valor en el tratamiento de la oliguria grave y anu-

ria de los pacientes que presentan toxemia del embarazo.


## CONCLUSIONI RIASSUNTIVE

Venne somministrata procaina endovena in 31 pazienti affette da tossiemia da gravidanza complicata da grave oliguria e anuria. Si ottennero buoni risultati in 21, risultati discreti in 4 (corrette 2) e risultati scadenti in 6 (corrette 2). La durata media dell'anuria fu di 18 e 30 ore, la durata minima di 6 ore. La quantità media di procaina endovena somministrata fu di 500 mg. diluita in 200 cc. di soluzione glucosata al 5%. L'intervallo medio intercorrente fra la somministrazione della procaina e l'inizio della diuresi fu di 6 e 8-10 ore; l'intervallo minimo di 6 ore. Dato che la procaina viene rapidamente metabolizzata il liquido fu somministrato in 8-10 minuti. La somministrazione di procaina causa uno stato apprensivo e dovrebbe quindi essere preceduta da un adeguato sedativo, preferibilmente da un barbiturico (sodium amytal endovena). Una caduta della pressione del sangue si verifica solo dopo che la diuresi si è ristabilita. La procaina endovena non ha alcun effetto nei casi di malattie organiche dei reni, mentre è invece un efficace mezzo nella cura di gravi oliguire ed anurie in pazienti con tossiemie da gravidanza.


## BIBLIOGRAPHY


Beecher, K.: The Physiology of Anesthesia. Oxford: Oxford University Press, 1938.

Beker, J. C.: Aetiology of Eclampsia, J. Obst. & Gynec. Brit. Empire 55:756-765, 1948.

Bier, A.: München med. Wchnschr. 1:589, 1909.

Brown, W. E., and Bradbury, J. T.: Effectiveness of Various Diuretic Agents in Causing Sodium Excretion in Pregnant Women, Am. J. Obst. & Gynec. 56:1-22, 1948.

Brown, W. E., and Bradbury, J. T.: Sodium and Water Excretion in Pregnant Women, J. Michigan State M. Soc. 48:174-182, 1949.

Estes, H.: Relation Between Convulsive Eclampsia and Diencephalon. Attempted Intravenous Procaine Therapy, Bruxelles Med. 28:1987-1997, 1948.

Fosdick, L. S., and Hansen, H. L.: Dental Cosmos 73:1082, 1931.

Giuffrida, F.: Intravenous Administration of Novocaine in Eclampsia, Facolte de Medicina e Chivurgia della Universita di Padova, Padua 27: 116-121, 1949.

Graubard, D. J., and Peterson, M. D.: Clinical Uses of Intravenous Procaine. Springfield, Ill.: Charles C Thomas, Publisher, 1950.

Hanely, C. A., and Keller, A. D.: Changes in Renal Function Produced by Morphine in Normal Dogs and Dogs with Diabetes Insipidus, J. Pharmacol. & Exp. Therapeutics 99:33, 1950.

Hatcher, R. A., and Eggleston, C. A.: J. Pharmacol. & Exp. Therapeutics 8:385, 1916.

Isenberger: Pharmacologic Action of Intravenous Procaine as an Analgesic Agent, Anesthesiology 10:382, 1949.

Kraushaar, O. F.; Bradbury, J. T.; Wang, V. K., and Brown, W. E.: Morphine Suppression of Urinary Output in Pregnant and Non-Pregnant Women, Am. J. Obst. & Gynec. 57:302-311, 1949.

Legge, J. W., and Durie: Procaine, M. J. Australia 2:561, 1942.

Mauzy, C. H., and Donnelly, J.: Oliguria and Anuria in Toxemias of Pregnancy, Am. J. Obst. & Gynec. 57:421-437, 1949.

Mengert, W. F., and Hermes, R. L.: Overtreatment of Eclampsia, J. Missouri M. A. 45:643-646, 1948.

Rodriguez, Lopez, M. B.: Anuria in Eclampsia: Successful Therapy by Intravenous Procaine Hydrochloride. Obstetrics and Gynecology, Am. 6: 44-50, 1948.

Rovenstine, E. A.: Therapeutic Role of Procaine and Its Derivatives, Bull. New York Acad. Med. 25:298, 1949.

Serwer, M. J.; Redmond, R. F.; Vammen, A. N.; Pitts, J. B., and Eskridge, J. B. III: Intravenous Procaine in the Promotion of Diuresis in Toxemias of Pregnancy, J. Oklahoma State M. A. 44:48-50, 1951.

Sollman, T.: Manual of Pharmacology. Philadelphia: W. B. Saunders Company, 1948. 7th ed., pp. 27, 277-278.

Stern, B. D.: Fluid and Electrolyte Balance, Western J. Surg., Obst. & Gynec. 58:344, 1950.

Turner, H. B.; DeLozier, O., and Whitacre, F. E.: Hydration Treatment of Eclampsia, J.A.M.A. 148:979-981, 1952.

Whitacre, F. E., and DeLozier, O.: High Fluid Intake in the Treatment of Eclampsia, Southern M. J. 44:638-643, 1951.


**Author's Note:** I wish to express my sincere appreciation to the following physicians, who kindly permitted me to include their cases: Dr. Robert Anspaugh, Dr. Charles Bodine, Dr. Daisy Cotten, Dr. J. B. Eskridge Jr., Dr. Rex Graham, Dr. W. K. Hartford, Dr. J. E. Highland, Dr. J. M. Parrish, Dr. Delbert Smith and Dr. Dan Tappen.

# Torsion of the Omentum

LAWRENCE S. MANN, M.S., M.D. F.A.C.S., F.I.C.S.

CHICAGO, ILLINOIS

TORSION of the omentum is a condition of obscure cause, occasionally encountered in the surgical treatment of acute abdominal disease. It is neglected in the differential diagnosis and is rarely diagnosed preoperatively. The most common diagnosis made is that of acute appendicitis, although omental torsion may simulate any acute abdominal surgical condition. During operation, the presence of blood or blood-stained fluid in the abdomen should make the surgeon aware of the possible existence of this condition. Care must be taken to examine the omentum, or the diagnosis may be missed.

Over 300 cases have been reported in the literature.[1] The age incidence varies but is very low for children, as is to be expected because of the short, poorly developed omentum lacking in fat. Anton, Jennings and Spiegel[2] have excellently reviewed the embryologic, phylogenic, histologic, anatomic and physiologic aspects of the omentum in addition to discussing the cause of omental torsion and the pathologic picture associated with it. These authors have proposed the following simple classification:

A. Primary (idiopathic, cryptogenic, pure intra-abdominal)
B. Secondary
   1. Hernial (external)
   2. Abdominal
      a. intrinsic (cysts, tumors, etc., of the omentum)
      b. extrinsic (associated with pathologic change in other abdominal and pelvic organs or in the peritoneum).

The right side of the omentum is more mobile than the left and is therefore more apt to be involved in torsion.[1e]. Patients with this condition are usually obese. The points in preoperative differential diagnosis as enumerated by various authors are usually too vague to be of practical value to the operating surgeon; nevertheless, this condition is a surgical emergency and requires prompt laparotomy.[1f] The treatment consists of ligation and resection of the involved portion of the omentum.[3] Recovery is usually rapid, complete and uneventful.

## REPORT OF A CASE

M. B., an obese white male engineer aged 27, was admitted to Mount Sinai Hospital on July 25, 1952, complaining of pain in the right lower abdominal quadrant. During the past

Resected omentum, showing site of torsion.

From the departments of Surgery, Mount Sinai Hospital and Chicago Medical School, Chicago.
Submitted for publication Jan. 9, 1954.

three months he had had generalized lower abdominal pain, relieved by lying down and flexing the legs. Three months prior to admission he was told that he had gastroenteritis and was given medication for the relief of pain. On the evening before admission he had generalized abdominal pain, which became localized to the right lower quadrant five hours prior to his entering the hospital. His past history was negative except for right inguinal herniorrhaphies performed in 1944 and 1946.

The temperature was 99.4 F., the pulse rate 82 and the blood pressure, in millimeters of mercury, 130 systolic and 90 diastolic. Exquisite tenderness was elicited in the right lower abdominal quadrant. Rebound tenderness was also present. Rovsing's sign was positive. Rectal tenderness was present in the direction of the right lower quadrant. A recurrent right inguinal hernia was present. The specific gravity of the urine was 1.025, and the hydrogen ion concentration was 5.5. There was a trace of protein but no acetone or sugar. Microscopic examination revealed occasional leukocytes, erythrocytes and epithelial cells. A blood count revealed 4,180,000 red cells per cubic millimeter, with 15.1 Gm. of hemoglobin (96.7 per cent) and 11,750 white cells, with 1 per cent stab cells, 80 per cent segmental cells, 8 per cent small lymphocytes and 11 per cent monocytes.

In view of these observations, a diagnosis of acute appendicitis was made and immediate operation advised. With the patient under general anesthesia, the abdomen was opened through a McBurney incision. As soon as the peritoneum was opened, free sanguineous fluid was encountered. The omentum was dark purplish, twisted clockwise and free in the abdomen at the inferior border. It contained tortuous blood vessels. The incision was extended. Since it was impossible to untwist the omentum, it was resected just above the pedicle, which was 2½ to 3 inches (6.7 to 7.5 cm.) from the transverse portion of the colon. The bowel was examined in its entirety and the abdomen explored. The appendix was injected and removed. The postoperative course was uneventful.

The pathologic report was as follows: "Six cm. of appendix, 8 mm. thick, lumen patent with fecal content; mucosa reddish. Piece of omentum previously fixed in formaldehyde, measures 30 by 15 cm. in its greatest dimensions." (See illustration.) "It presents a narrow pedicle, which is twisted, and in the twisted area distended veins are noted. Section through these veins reveals that they are almost completely filled with recently clotted blood. Gross and microscopic diagnosis: (1) acute suppurative disease of the appendix and (2) hemorrhagic infarct of the omentum, with organizing venous thrombosis."

During the seventeen-month follow-up the patient had no further complaints. The right recurrent inguinal hernia was repaired with tantalum mesh.

## SUMMARY AND CONCLUSIONS

A case of omental torsion is reported. The author points out that torsion of the omentum should be considered in the differential diagnosis of the acute abdomen. The presence of blood or blood-stained fluid in the abdomen should make the surgeon aware of this condition.

## RÉSUMÉ ET CONCLUSIONS

Un cas de torsion du grand épiploon est décrit. L'auteur signale que cet état pathologique devrait figurer dans le diagnostic différentiel des affections de l'abdomen aigu. La présence de sang ou de liquide sanguinolent dans l'abdomen doit rendre le chirurgien attentif à cette possibilité.

## ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

Der Verfasser berichtet über einen Fall von Torsion des Omentums und betont, dass diese Erkrankung in der Differentialdiagnose akuter Bauchzustände berücksichtigt werden sollte. Die Anwesenheit von Blut oder blutiger Flüssigkeit in der Bauchhöhle sollten den Chirurgen an diese Erkrankung denken lassen.

## CONCLUSIONI RIASSUNTIVE

Viene riferito un caso di torsione dell'omento. Questa affezione deve essere presa in considerazione nella diagnosi differenziale dell'addome acuto, specialmente quando vi è presenza di liquido ematico in cavità peritoneale.

RESUMO

É relatado um caso de torsão do epiplon, salientando o autôr que tal afecção deve sêr encarada nos casos de se proceder o diagnostico diferencial nos doentes portadôres de abdomen agude.

A presença de sangue ou liquido serosanguineo na cavidade abdominal, deve levar a atenção do cirurgião para tal enfermidade.

RESUMEN Y CONCLUSIONES

Se comunica un caso de torsión del epiplón. El autor señala que la rotación del epiplón debe ser considerada en el diagnóstico diferencial del abdomen agudo. La presencia de sangre ó de líquido sanguinolento en el abdomen debe de prevenir al cirujano de la existencia de este padecimiento.

REFERENCES

1. (a) Morris, J. H.: Torsion of the Omentum, Arch. Surg. 24:40-76, 1932. (b) Killinger, R. R.: Torsion of the Omentum, J. Florida M. A. 31: 61-64, 1944. (c) Sterling , J. A., and Goldsmith, R.: Primary Torsion of the Omentum, Rev. Gastroenterol. 18:106-112, 1951. (d) Cave, W. H.: Primary Torsion of the Omentum, Illinois M. J. 101:97-98, 1952. (e) Jackson, A. S.: Primary Torsion of the Omentum, Am. J. Surg. 75:849-851, 1948. (f) Puderbach, W. J.: Torsion of the Omentum, New York State J. Med. 49:1571-1572, 1949. (g) Wiesman, I.: Torsion of the Omentum: Survey of the Syndrome and Report of a Case, J. Internat. Coll. Surgeons 14:734-736, 1950. (h) Martin, J. D.: Torsion of the Omentum, Southern Surgeon 10:210-215, 1941. (i) Simon, M. M., and Saiken L.: Complete Torsion of the Omentum through the Loop of an Anomalous Vein, New York State J. Med. 50:2307-2308, 1950.

2. Anton, J. I.; Jennings, J. E., and Spiegel, M. B.: Primary Omental Torsion, Am. J. Surg. 68: 303-317, 1945.

3. Leitner, M. J.; Jordan, C. G.; Spinner, M. H., and Reese, E. C.: Torsion Infarction and Hemorrhage of the Omentum as a Cause of Acute Abdominal Distress, Ann. Surg. 135:103-110, 1952.

Sculpture, so neglected on account of the current contempt for form and mass in favour of the fluid, is undoubtedly one of the noblest arts. To begin with, it is the only one which obliges us to move round it.

In feeling his way an artist may open a secret door and never discover that behind this door a whole world lay concealed.

Tradition appears at every epoch under a different disguise, but the public does not recognize it easily and never discovers it underneath its masks.

The extreme limit of wisdom is what the public calls madness.

—*Cocteau*

# Systemic Manifestations of Anorectal Disease

GEORGE H. THIELE, M.D., F.A.C.S., F.I.C.S.
KANSAS CITY, MISSOURI

THE proctologist often witnesses the cure of a number of clinical symptoms not generally recognized to be due at times to anorectal disease.

A study of the histories of patients seen in a private proctologic practice reveals that more than one-third of them complained of symptoms not ordinarily considered to be of anorectal origin.[1] A statistical review reveals that two-thirds of these symptoms are cured by eradication of the causative anorectal disease.

Further observations reveal that these associated symptoms can be classified as follows: Gastrointestinal, genitourinary, cardiorespiratory, and a final group due directly or indirectly to focal anorectal infection. The last-mentioned group of symptoms includes two subgroups. one, symptoms of the arthritic type, and the other, symptoms secondary to associated spasm of the pelvic muscles.

An inquiry into the mode of production of all the associated symptoms seems to be in order. All except those due directly or indirectly to focal anorectal infection can be explained on the basis of reflex irritation of the autonomic and cerebrospinal nervous systems, which together provide reflex pathways to all other organs of the body.

A short résumé of the anatomic and physiologic aspects of the autonomic nervous system will be found helpful.

*The Autonomic Nervous System.*—The autonomic nervous system is composed of two portions, (a) the sympathetic portion and (b) the parasympathetic or craniosacral portion.

The sympathetic system takes its origin from that portion of the spinal cord extending from the first thoracic to the third or the fourth lumbar segment and consists of five parts:

1. A chain of ganglia lying on each side of the vertebral column, there being as a rule one ganglion for each spinal nerve root. These ganglia are called lateral or vertebral ganglia.

2. Numerous ganglia situated farther away from the spinal canal, termed collateral or prevertebral ganglia; and still others lying on or in the muscle of the viscera, as in the rectum, bladder, and genital organs, called terminal ganglia. The collateral ganglia include the cervical, stellate, semilunar, superior and inferior mesenteric ganglia.

3. Numerous plexuses of fibers that supply the various tissues.

4. White rami communicantes, which are efferent connector neurons between the lateral horns of the cord and the lateral ganglia.

5. Grey rami communicantes, which are afferent connector neurons between the sympathetic and cerebrospinal systems.

The parasympathetic system consists of two portions, the craniobulbar and the sacral. The craniobulbar portion includes the third, seventh, ninth and tenth cranial nerves; of these we are concerned with the tenth, or the vagus. The sacral nerve (so-called pelvic vagus) has its origin at the level of the first and second lumbar vertebrae, passes out through the second, third and fourth sacral nerves and ends in the ganglia lying on the surface of the rectum, bladder and other pelvic organs.

*Physiologic Function of the Vegetative Nervous System.*—There are marked differences in the functional responses of the two components of the autonomic nervous system to central stimulation. There are sound anatomic reasons for these differences. Langworthy[2] stated that the pre-

Read at the Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.
Submitted for publication Oct. 14, 1953.

ganglionic fibers of the sympathetic system are comparatively short and the postganglionic fibers quite long. As a result of numerous connecting and decussating fibers between ganglia at various levels of the cord, the effects of stimulation of the sympathetic preganglionic fibers are very widespread and affect practically the entire body. This is true particularly as regards the effect of sympathetic stimulation upon the caliber of the blood vessels of the body.

Conversely, the parasympathetic preganglionic fibers are relatively very much longer than are the sympathetic preganglionic fibers, and the ganglia are located very close to the organs they supply. This arrangement therefore confines the effects of preganglionic parasympathetic stimulation within quite narrow limits.

Langworthy[2] and Reid[3] have pointed out that responses to both sympathetic and parasympathetic stimulation are dependent upon the production of a chemical substance that acts as a protoplasmic bridge between the nerve and the muscle or gland, as the case may be. In the case of the sympathetic portion of the system, this chemical is epinephrine; in the case of the parasympathetic portion, the chemical is cholin. The sympathetic system is therefore described as adrenergic and the parasympathetic system as cholinergic. These facts serve to explain the effect of epinephrine as a sympathetic stimulus, and of cholin as a parasympathetic stimulus, and form the basis for present-day therapy of functional disturbances of the autonomic nervous system.

All autonomically innervated structures receive both sympathetic and parasympathetic fibers. Briefly stated, stimulation of the sympathetic fibers produces contraction of the sphincters of the gastrointestinal and urinary tracts, and of the ureters, and relaxation of all other smooth muscle of these tracts; acceleration of the heart, and relaxation of the visceral blood vessels; and decreased secretion of the visceral glands. Conversely, parasympathetic stimulation produces relaxation of the sphincters of the gastrointestinal and urinary tracts, and contraction of all other smooth muscle of these tracts except the ureter, upon which there is no effect; slowing of the heart rate; no effect on the visceral blood vessels; and increased secretion of the visceral glands.

In spite of the contrasting effects of sympathetic and parasympathetic stimulation, these two components, rather than being antagonistic, are really synergistic. Ordinarily, for a given muscular structure, one innervation is augmentative and the other inhibitive, although there is no rule that will always apply as to which is augmentative and which is inhibitive. For instance, sympathetic stimulation ordinarily produces relaxation of smooth muscle, but in the case of the smooth muscle sphincters contraction results.

It is readily seen, therefore, that normal physiologic function of the gastrointestinal, cardiorespiratory and genitourinary systems is probably dependent upon the maintenance of balance between sympathetic and parasympathetic impulses, and that a disturbance of this balance may result in disturbed muscular tone, motility, glandular secretion and blood supply of the organs composing these systems.

Lack of space precludes the citation of any of the numerous available case histories illustrating each of the following types of referred symptoms from anorectal disease. The important point is to recognize the relation that exists.

*Gastrointestinal Disturbances.*—Gastrointestinal disturbances resulting from autonomic reflexes initiated by disease of the anorectum are of several different types.

As the result of sympathetic stimulation, gastric hypoacidity and hypomotility may occur.

All surgeons are familiar with the appearance of ileus as a complication of abdominal operations or intra-abdominal disease. Just as frequently, however, one encounters partial arrest of intestinal peristalsis after an anorectal surgical procedure. Lyons and Caliva,[4] citing Christopher,[5] stated that neither in complete ileus nor in the "lazy bowel" just referred to is

the intestinal wall in any sense paralyzed. Its activity is rather inhibited by an overactive sympathetic nervous system such as is observed in the sympathicotonic person, or such as results from sympathetic stimulation from anorectal disease. Ileus and associated conditions are examples of sympathetic hypertonia.

Gastrointestinal disturbances occurring as the result of parasympathetic hypertonia occur somewhat more frequently than does sympathetic hypertonia. They include heartburn, acid eructations and epigastric distress due to gastric hypersecretion and hypermotility, and abdominal colic associated with irritability and hypermotility of the colon.[6]

Examples of autonomic dystonia cannot be said to result from anorectal disease but, as in the case of Hirschsprung's disease and cases of prolonged cardiospasm, as noted by Alvarez[7] and Lendrum,[8] are much more reasonably explained upon the basis of the absence of ganglion cells in the myenteric plexuses.

*Genitourinary Disturbances.* — Reflex disturbances associated with anorectal disease frequently involve the genitourinary system.[9] There are very sound physiologic and anatomic reasons why this is so. For instance, the vesical and genitourinary organs are supplied sympathetically through the inferior mesenteric ganglion, collateral to the ganglia at the first, second, third and fourth lumbar levels. It is also to be noted that the parasympathetic innervation of the bladder and genital organs originates at the first and second lumbar levels of the cord, emerging through fibers from the second, third and fourth sacral nerves in the so-called pelvic vagus nerve.

The close neurologic association of the rectum and bladder is exemplified by the expulsion of flatus during urination and by the fact that urination almost invariably accompanies defecation.

*Urinary Disturbances.*—The most common urinary symptoms resulting from anorectal disease are increased frequency and urgency of urination. These symptoms may rise through two entirely different types of reflexes:

1. Parasympathetic reflexes. The usual reflex from an anal lesion is parasympathetic in origin and produces contraction of the urinary bladder, with a functional loss of tone of the vesical sphincter. Frequency of urination, with passage of small amounts of urine, results because of reduced bladder capacity and poor sphincteric tone and control.

2. Sympathetic reflexes. Frequency of urination may also result from sympathetic reflexes which manifest themselves in dilatation of the bladder, with concomitant spasm of the vesical sphincter. This is exemplified by the typical atonic bladder most commonly encountered postoperatively. If the retention of urine is allowed to continue long enough without catheterization, frequency of the dribbling type results. Aside from the postoperative cases, a number of examples of this type of reflex have been seen; indeed, it may produce the only subjective symptoms of anorectal disease and may exist with a perfectly normal urinary apparatus.

*Genital Disturbances.—Menstrual*: The onset of a menstrual period at an irregular time as the result of hemorrhoidectomy is not uncommon, and menorrhagia, metrorrhagia, oligomenorrhea and amenorrhea are all occasionally relieved by anorectal surgery.

*Reflex Ejaculation*: *In the male*, reflex ejaculation, with sudden embarrassing seminal emission, may be the chief complaint even though the lesion is entirely of anorectal origin. Smithwick and White[10] stated that the autonomic nerves play the double role of engorging the penis with blood and causing ejaculation by contracting the smooth muscle of the vaso differentia, the seminal vesicles and the prostate.

*Other Disturbances*: Genital symptoms in both sexes may be the result of reflexes through the cerebrospinal system, as evidenced by testicular pain in the male and by vaginismus secondary to levator ani spasm in the female.

*Cardiorespiratory Symptoms.*—One has only to remember that the heart rate is controlled by vagal and sympathetic impulses, and that any disease that abnormally stimulates either the vagus or the sympathetic nervous system may produce changes in the rate of rhythm of the pulse. In addition, if one admits that focal infection may cause functional disturbances of the heart, such as extra-systoles, and organic disease, such as endocarditis, one must include focal anorectal infection in the list along with abscessed teeth, chronic cholecystitis, nasal sinusitis, and tonsillitis.

*Symptoms Due to Focal Anorectal Infection Arthritis.* — In addition to the symptoms of rapid pulse, fever and general malaise that may accompany any acute suppurative anorectal infection, systemic symptoms may include those of acute or chronic arthritis. The case records of any busy proctologist are replete with instances of relief of acute arthritis as the result of eradication of anorectal foci of infection.

*Pelvis muscle spasm* secondary to anorectal focal infection accounts for a second group of symptoms, which includes (a) coccygodynia and (b) pain in the superior gluteal area, in the region of the hip joint, and down the back of the leg along the course of the sciatic nerve.

*Coccygodynia*: A twenty-year study of the syndrome of coccygodynia reveals that, almost without exception, all patients exhibit unilateral or bilateral spasm of the levator ani muscles.

Study of almost 400 cases of pelvic muscle spasm reveals that anal infection has been the causative factor in about two-thirds of the cases. Spasm in the remaining one-third was due either to focal infection in the genitourinary organs or to trauma. It was noted that the focal infections responsible for muscle spasm all occurred in areas from which the lymphatic drainage is through the pelvic channels.[11] Evidence that this is true is substantiated by the common observation on digital rectal examination of lymphadenopathy of the glands overlying the pelvic muscles.

The effect of levator spasm is sustained and painful hyperflexion of the coccygeal and sacrococcygeal joints. In many patients, as the result of myositis secondary to anorectal infection, the site of most severe pain is in the levatores themselves rather than in the sacrococcygeal or coccygeal joints. Surprisingly enough, pressure with the thumb against the tip of the coccyx does not often exacerbate the pain, even though the patient may just have stated that he could not sit comfortably because of painful pressure against the tip of the coccyx.

The rationale of treatment of coccygodynia by massage of the levatores ani and removal of anorectal foci of infection has been thoroughly discussed in previous papers.[12] It is sufficient to say that satisfactory results have been obtained in more than 85 per cent of cases.

*Pain Across the Lower Part of the Back, in the Superior Gluteal Region, in the Region of the Hip Joint, and Along the Course of the Sciatic Nerve.*—During the past twenty years I have seen more than 200 proctologic patients whose histories included the syndrome of pain just mentioned. It may be either unilateral or bilateral. Frequently the syndrome is accompanied by coccygodynia.

The typical history of the patient is as follows: There is generally a gradual onset of backache fairly well localized to the sacral area. The backache is constant and seems to be almost as severe in the early part of the day as in the latter part. Radiation to the area of the hip joint, just posterior to the trochanter of the femur, is quite common, as is also radiation to the superior gluteal portion of the buttocks. Leg pain, when it occurs, in general follows the course of the sciatic nerve and almost without exception extends down the thigh as far as the knee. Radiation of the pain down the outside of the leg from the knee to the ankle is not uncommon, however. The pain down the thigh varies from mild aching to the most severe boring, aching pain, during which the patient is unable to place the leg in a comfortable position even though he may

be in bed. He will often point out an area of tenderness on pressure along the lower lateral border of the sacrum, and often another tender area just posterior to the trochanter of the femur.

In cases of severe involvement the patient walks rather stiffly, the usual freedom of motion of the hip joints being somewhat restricted, although the patient may not so state when describing his complaints. One may often elicit a history of tenderness over the superior gluteal region, over the sacrosciatic foramen, or over the point of insertion of the piriformis muscle into the posterior side of the trochanter of the femur.

The cause of the symptoms just described is adequately explained on the basis of tonic spasm and myositis of the piriformis muscle. Pressure of the spastic muscle on the superior gluteal nerve produces pain over the upper third of the buttocks; pressure of the lower border of the muscle against the sciatic nerve accounts for the pain in the distribution of that nerve; and pain posterior to the trochanter of the femur is due to myositis involving the insertion of the tendinous end of the muscle into the trochanter. The sacral backache is due to the fact that the myositic muscle takes its origin from the anterolateral part of the sacrum, and that the piriformis muscle is the only muscle that bridges the sacroiliac joint.

A detailed description and exposition of the piriformis muscle syndrome and its treatment by massage, may be found in previous papers.[12]

Treatment of this syndrome by massage of the spastic piriformis muscles and removal of anorectal foci of infection is abundantly satisfactory in about two-thirds of the cases. Orthopedic consultation should be used freely to reduce diagnostic error.


## SUMMARY

The referred symptoms of anorectal disease are enumerated and classified on anatomic and physiologic bases. Gastrointestinal, genitourinary and cardiorespiratory symptoms are explained on the basis of nervous reflexes involving the autonomic and cerebrospinal nervous systems.

A fourth group of symptoms resulting from anorectal focal infection includes arthritis and two additional syndromes resulting from pelvic muscle spasm secondary to anorectal infection.

It is hoped that this paper will stimulate further inquiry into the relation of proctology to the general and associated special fields of medicine.

## ZUSAMMENFASSUNG

Die im Zusammenhang mit anorektalen Erkrankungen auftretenden Symptome werden aufgezählt und nach anatomischen und physiologischen Gesichtspunkten klassifiziert. Symptome seitens des Magendarmkanals, der Harn- und Geschlechtsorgane und des Gefäss- und Atmungsapparats werden durch autonome und zerebrospinale Nervenreflexe erklärt.

Zu einer vierten Gruppe von als Folge von anorektalen Herdinfektionen auftretenden Symptomen gehören die Arthritis und zwei weitere durch sekundäre Spasmen der Beckenmuskeln entstehende Syndrome.

Die Arbeit soll zu einem weiteren Studium der Beziehungen zwischen der Proktologie und der allgemeinen Medizin mit ihren Spezialgebieten anregen.

## RÉSUMÉ

Les symptômes des affections ano-rectales sont énumérés et classés sur des bases anatomiques et physiologiques. Les symptômes gastro-intestinaux, génito-urinaires et cardio-respiratoires dépendent des reflexes du systéme nerveux autonome et cérébro-spinal.

Ajoutons que la symptomatologie peut être compliquée d'une infection focale anorectale, qui peut provoquer un état de spasme des muscles pelvi-rectaux, ou 'une affection arthritique.

L'auteur exprime le désir que ce travail provoque d'autres recherches en proctologie et en médecine générale.

RESUMEN

Se enumeran y clasifican sobre una base anatómica y fisiológica los síntomas referidos a padecimientos anorectales. Los síntomas hastrointestinales, genitourinarios y cardiorespiratorios son explicados sobre la base de reflejos nerviosos que envuelven los sistemas nerviosos autónomo y cerebroespinal.

Un cuarto grupo de síntomas resultantes de infección focal anorectal incluye artritis y dos síndromes adicionales resultantes de espasmo muscular pélvico secundario a infección anorectal.

Se espera que este artículo estimulará la interrogación, acerca de la relación de la proctología con los campos generales y especiales de la medicina.

RESUMO

São classificados em bases anatômicas e fisiologicas os sintômas marcantes das doenças ano-retais. Os sintômas gastrointestinais, genito-urinarios e cardiorespiratórios são classificados como baseados em reflexos nervosos involvendo o sistôma autonomo e o sistêma cerebroespinhal.

Um quarto grupo-de sintômas sesultantes de infecções focais anoretais incluindo artrites e duas sindrômes adicionais resultantes de espasmo do musculo pelvico consequente a infecção ano-retal, é tambem descrito.

Deseja o autôr que o seu trabalho venha estimular um exame mais acurado dos doentes, por parte dos proctomolgistas, encarando todos os demais campos da Medicina.

RIASSUNTO

Vengono elencati e classificati su basi anatomiche e fisiologiche i sintomi delle malattie anorettali. Vengono spiegati, inoltre, i disturbi gastrointestinali, genitourinari e cardiorespiratori sulla base di riflessi che interessano il sistema nervoso e quello autonomo. Un quarto gruppo di sintomi è legato e infezioni focali anorettali e comprese le manifestazioni artritiche e altre 2 sindromi da spasmo dei muscoli pelvici. Ci si augura che vengano approfonditi i rapporti fra la proctologia e gli altri campi della medicina.

REFERENCES

1. Thiele, G. H.: Clinical Manifestations of Anorectal Disease, J. Missouri State M. A. **36**: 85-88, 1936.

2. Langworthy, O. O.: General Principles of Autonomic Innervation, Arch. Neurol. & Psychiat. **50**:590, 1943.

3. Reid, L. C.: Fundamental Concepts of Autonomic Function, New York State J. Med. **50**:1797-1801, 1950.

4. Lyons, R. H., and Caliva, F. S.: The Clinical Manifestations of Autonomic Dysfunction, New York State J. Med. **50**:1801-1809, 1950.

5. Christopher, F.: Textbook of Surgery. Philadelphia: W. B. Saunders Company, 1949. 5th ed.

6. Thiele, G. H.: The Referred Symptoms of Anorectal Disease, J. Missouri State M. A. **31**: 20-24, 1934.

7. Alvarez, W. C.: A Simple Explanation for Cardiospasm and Hirschsprung's Disease, Gastroenterol. **13**:422, 1949.

8. Lendrum, F. C.: Anatomic Features of the Cardiac Orifice of the Stomach, with Special Reference to Cardiospasm, Arch. Int. Med. **59**:474, 1937.

9. Thiele, G. H.: The Genito-urinary Symptoms of Anorectal Disease, South M. J. **39**:166-172, 1946.

10. Smithwick, R. H., and White, J. C.: The Autonomic Nervous System: Anatomy, Physiology, and Surgical Application. New York: The Macmillian Company, 1948.

11. Thiele, G. H.: Coccygodynia: The Mechanism of its Production and its Relationship to Anorectal Disease, Am. J. Surg. **69**:110-116, 1950.

12. (a) Thiele, G. H.: Tonic Spasm of the Levator Ani, Coccygeus and Piriformis Muscles, Tr. Am. Proc. Soc., 1936. (b) Thiele, G. H.: Coccygodynia and Pain in the Superior Gluteal Region and Down the Back of the Thigh, J.A.M.A. **109**:1271-1274, 1937. (c) Thiele.[11]

# Section on Ophthalmology and Otorhinolaryngology

PAUL C. CRAIG, M.D., F.A.C.S., F.I.C.S.

# Surgical Treatment of Perilenticular Membranes in Children

OTIS R. WOLFE, M.D., F.I.C.S.

MARSHALLTOWN, IOWA

BLINDNESS in children resulting from developmental or exudative tissue, either in front of the lens or behind it, is the subject of this paper. The children whose cases are reported fall into three main groups: those with anterior pupillary membranes, those with posterior membranes, and those with retinopathies.

Small threadlike pupillary membranes are encountered rather frequently. Anterior pupillary membranes sufficient to obstruct vision are infrequent. In pupillary membranes the strands are always attached to the inner circle of the iris. I have discussed the subject with a number of experienced surgeons, and few had encountered membranes as heavy as those in Cases 1, 2 or 3. Posterior membranes dense enough to obstruct vision are encountered more frequently. They have been described by various authors as tunica vasculosa, hyaloid artery remnants, opaque hyaloid sheaths, cyclitic or exudative membranes, etc. There are also descriptions of vitreous tumors, malignant and nonmalignant, cysts, filaments with or without cholesterin crystals (synchisis scintillans), etc. They will not be discussed in detail here, however, as this paper is a presentation of clinical surgical experiences.

One common observation was conspicuous in the children who had posterior membranes; the lenses were smaller and definitely thinner than the average. This does not apply to the conditions diagnosed as secondary, exudative or cyclitic. This has been particularly true in the cases diagnosed as having hyaloid membranes. (This fact definitely suggests a retarded developmental process.) A well-dilated pupil with a good central opening through the visual obstruction, be it capsule or membrane, is the acme of surgical achievement. A concentric residual ring of membrane gives strength and support to the vitreous. If the pupillary aperture is large enough to permit slit lamp examination, one can make a fairly accurate differential diagnosis. I always attempt to analyze the lens with the slit lamp before I suck it out, but I cannot always do so with young babies and children. A small hand slit lamp is especially helpful with babies.

Before the surgeon terminates his operation for any structural obstruction, cataract or membrane, he should try to be certain that the rear drainage angle is free. When the pupil is large, the surgeon can be fairly certain that it is free. When the pupil is small, the surgeon is much less certain that the filtration angle

From the Eye Department of the Deaconess Hospital, Marshalltown.

Read at a meeting of the Section on Ophthalmology, Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, Sept. 13-17, 1953.

Submitted for publication Jan. 24, 1954.

is free than if he does an iridectomy. There is no greater safety measure than a good iridectomy, and it can be the greatest single factor in preventing secondary glaucoma. This is true especially in the cases of young children, who have a tendency to excessive formation of cyclitic exudate and scar tissue.

Some surgeons do simple needlings even when the pupils are small and "get by" with sufficient absorption to prevent blocking of the drainage angle. They do not like to risk marring the iris margins, thereby obtaining a poor cosmetic effect. The cosmetic result is important, but not of the first importance. Elimination of a soft lens is greatly facilitated by sucking out the lens débris rather than allowing it to absorb after a needling. Nature gives good absorption after needling in about half the cases but does it imperfectly in the other half. The surgeon does not know in advance in which case good absorption will occur with a needling alone. Why leave it to chance? It is an incomplete operation.

Good dilatation, or an enlarged pupil, is the keynote in surgical conduct of juvenile cataract. A simple needling alone should never be performed in a small pupil or in the presence of synechiae or microphthalmus. A 7 to 9 mm. pupil is highly desirable. If the pupil cannot be dilated to more than 5 mm., I definitely advise against performing a needling alone.

Free normal lens substance is always absorbable to a degree. The normal lens capsule is difficult to absorb and should be eliminated surgically, especially the zonular type. I favor opening the anterior capsule first with a cystotome, followed by a tooth forceps. Retained capsule often embraces and surrounds some of the lens adjacent to the edges of the iris. A small remnant of capsule may fold over in front of the iris or behind it. A capsular tag is not infrequently pushed into the corneal wound. The ensuing swelling of the lens substance may allow a capsular tag to come into close apposition with the edges of the iris and adhere to it, presenting a cystic appearance. These factors are true especially where there is considerable inflammatory reaction. The center of the pupil may even be free or open, permitting fairly good vision, and still unabsorbed capsule and lens behind the iris may block drainage from the posterior to the anterior chamber, or the filtration angle. These factors account for the not infrequent occurrence of secondary glaucoma after needlings.

An entirely different mechanical situation presents itself when a needling is performed with a widely dilated pupil or a good iridectomy. The iris is drawn away from the convex curve of the lens, and wider discission of the capsule can be performed. The lens, as it softens, is then free to push out into the anterior chamber. Fragments of the anterior capsule do not often fold over the edges of the iris. If they do, they less frequently contain lens substance and exudate, and scar tissue does not form readily. The filtration angle of the iris is not nearly so apt to be blocked, and secondary glaucoma is obviated. Patients with large pupillary apertures are much easier to deal with surgically, and here, suction removal of the lens gives the nearest to the ideal result. The zonular type (inherited) usually dilates well.

These arguments obtain particularly with the zonular type, for which I favor a two-step technic. In zonular or lamellar types, the involvement or obstructing tissue is in the lens proper. The capsule is normal and is not usually involved. Being normal, it does not absorb so readily. In either anterior or posterior capsular cataracts this may or may not be true. The capsule may, however, become very firm when it takes on exudate from trauma (surgical or accidental) or from any inflammatory process.

A clear posterior capsule at the time of operation for zonular cataract sooner or later becomes a heavy, opaque exudative membrane and is no longer merely capsular. The younger the patient, the more likely is the exudative process to occur.

It is entirely consistent to reason that this exudative process may progress, be hidden behind the iris and be overlooked

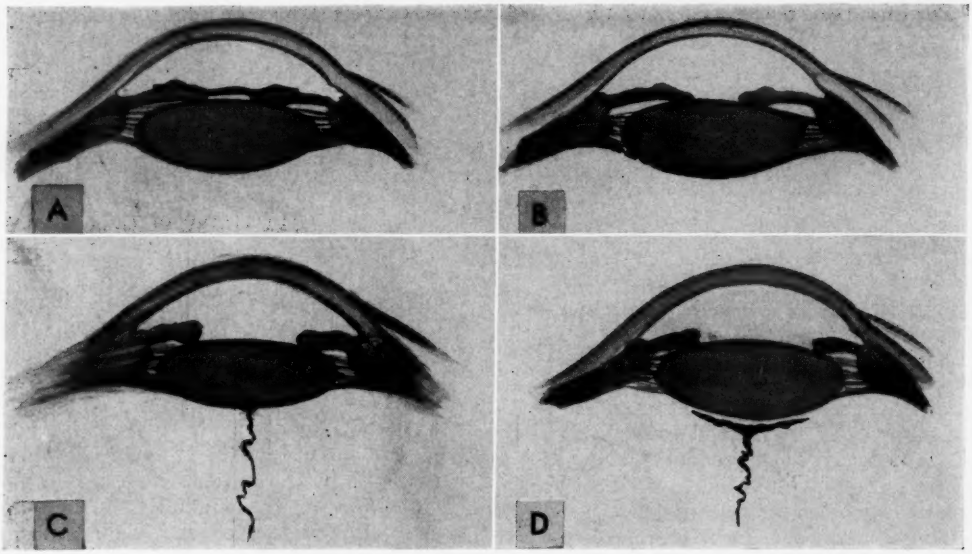



Fig. 1.—*A*, schematic drawing of an anterior pupillary membrane. Usually the membranes are only strands and do not obstruct vision sufficiently to require surgical intervention, which is advisable only when the membranes do cause partial obstruction of vision. The strands and the membrane shown in Plate 1 (opposite p. 654) begin at the inner circle of the iris. *B*, schematic conception of a posterior polar cataract and hyaloid artery. Usually the artery remnant is small and thin like a floating thread. Unless there is a cyclitic membrane or an opacity of the hyaloid sheath accompanying it, with vision markedly reduced, surgical intervention is not advisable. *C*, schematic conception of posterior membranes, tunica vasculosa or hyaloid sheaths; or cyclitic membranes. The illustration represents individual or combined opacities and obstruction to vision encountered in the author's practice. *D*, posterior hyaloid artery and occluding membrane accompanying partial cataract (postoperative schematic conception). This type of patient is usually blind in one eye and may be blind in both. The first step is quick removal of the lens by suction (the lenses are usually thin). After the operative hyperemia has cleared, the posterior opacity is revealed and the second step, by the curved knife and hook, is performed (see technic, Fig. 3). Such lenses are usually thin, and sometimes the posterior opacity can been seen on the table with the ophthalmoscope after the lens has been sucked out.

while it is blocking the filtration angle.

It is far better, and on the side of conservation of vision, to perform an iridectomy, with a disfigured pupil and a free drainage angle, than to run the chance of glaucoma by trying to avoid iridectomy. It is frequently a difficult question for the surgeon to decide, because cosmetic results are very important; but continued visual function is more important and must be given first consideration.

A family history of cataract or some other disease of the eyes was present in more than half of the cases here presented. Pregnancy may have been short or full term. A cataract at a more or less advanced stage was usually present. The lenses average much thinner than normal. The posterior membranous opacity is usually not seen until the lens has been removed, so that a diagnosis is infrequently made in advance of the first operation. If the baby is totally blind, it is advisable to operate at an age as early as 6 months. Differential diagnosis of the type of posterior membrane is difficult and often impossible. There may be a thickened plastic posterior capsule, an exudative cyclitic membrane or a hyaloid opacity present to obstruct vision. After the operative hyperemia has subsided, greyish white filaments or spangles are frequently seen in the vitreous by slit lamp examination. The color distinguishes these from ordinary

blood vitreous floaters. They are not threadlike and are not free in the vitreous but are attached, with one end floating free. I removed some heavy ones from an adult by the hook technic after cataract extraction several years ago. One eye softened and degenerated afterward, but the other still has fairly good vision.

Cases 4 to 17 inclusive, with their illustrations, indicate my experience with posterior membranes. The operations were largely of the nature of salvage, as there were many complications to be met. My line of reasoning is that if there is tissue obstructing vision it is incumbent upon me to try to clear the media, regardless of my inability to identify the membranous tissue beforehand. Performing iridectomies, opening membranes and removing scar tissue do not always result in a good-appearing eye. An iridectomy is, however, a great safety procedure when any kind of lens débris, tissue or exudate is present. If these exist and the surgeon works through a small pupil, he is never certain that drainage from the posterior to the anterior chamber is obtained, or that the filtration angle is free. If it is not free, hypertension may result, causing a slow, insidious noninflammatory glaucoma.

If there is a chance to clear the media and obtain useful vision by opening or removing any kind of obstructing membrane, I feel justified in operating on the basis of salvage. I do, however, have a clear understanding with the parents that I can promise nothing; such cases must be viewed from the standpoint that the child has everything to gain and nothing to lose. My results in these complicated cases are in the 50 per cent bracket.

*Treatment of Retinopathies.*—The mechanical removal of a cataract or the opening of an occluding membrane does not terminate the responsibility of the ophthalmologist. Except for the congenital zonular type, cataract is only one manifestation of a sick eye. In children especially, since nature has not completed the developmental process, there is frequently much that can be done to improve vision. One can often prevent or control inflammations and degenerative processes that would cause damage to the retina or the uveal tract. The ophthalmologist, the pediatrician, and the endocrinologist can

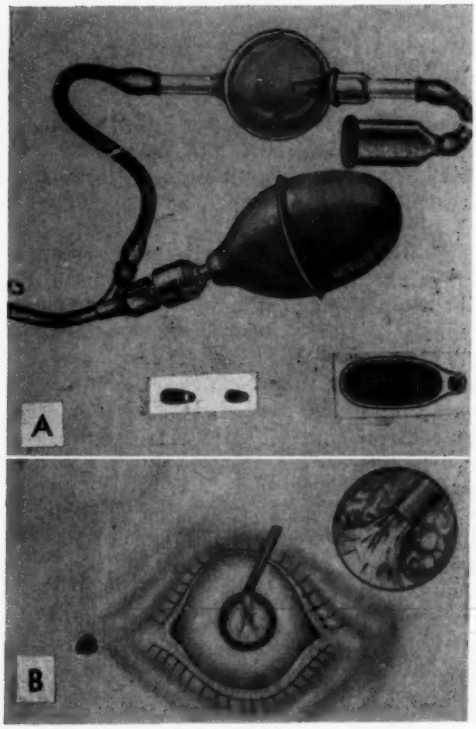



Fig. 2.—*A*, author's double cannula suction and lavage instrument. Briefly, it effects quick elimination of any soft cataractous lenses (either wholly or partly opaque) by oral suction.* This quick elimination of the cataract has greatly facilitated my early analysis of opacities of the posterior quadrant and of the vitreous. In cases of total soft cataract, suction is performed in one step after a capsulotomy with a Schweiger type forceps. In cases of zonular uncomplicated cataract, suction extraction is performed a few days after a classic needling. For an uncomplicated soft cataract with a well-dilated pupil, the results are well up in the 90 per cent bracket. In complicated cases, with small or poorly dilated pupils, synechiae, microphthalmus, etc., an iridectomy should be performed and, of course, the results have not been quite as good. *B*, double-barrel cannula inserted into the anterior chamber through a small corneal incision. The soft lens is aspirated through the large tube by oral suction. The anterior chamber is kept full of fluid injected through the small part of the cannula from the rubber bulb. The presence of the fluid in the anterior chamber greatly expedites the suction.

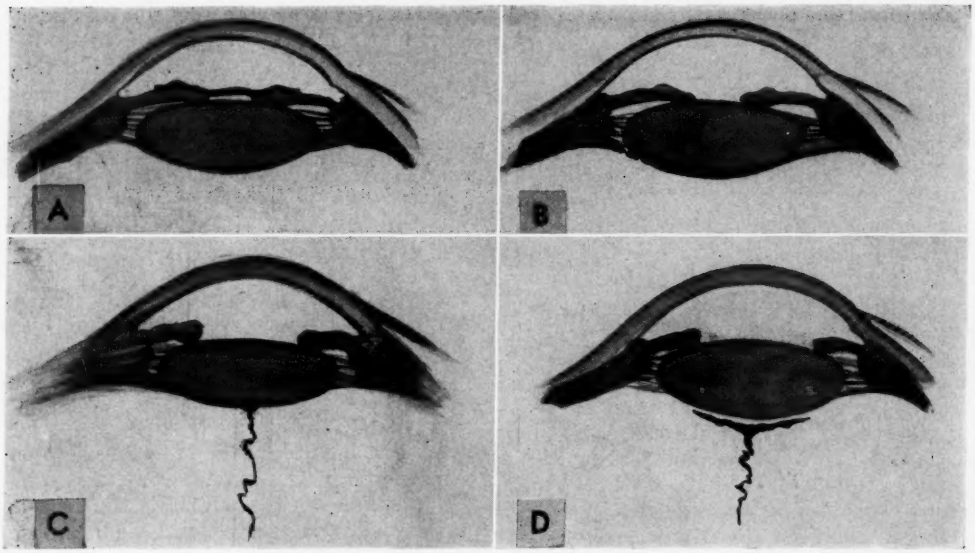



Fig. 1.—*A*, schematic drawing of an anterior pupillary membrane. Usually the membranes are only strands and do not obstruct vision sufficiently to require surgical intervention, which is advisable only when the membranes do cause partial obstruction of vision. The strands and the membrane shown in Plate 1 (opposite p. 654) begin at the inner circle of the iris. *B*, schematic conception of a posterior polar cataract and hyaloid artery. Usually the artery remnant is small and thin like a floating thread. Unless there is a cyclitic membrane or an opacity of the hyaloid sheath accompanying it, with vision markedly reduced, surgical intervention is not advisable. *C*, schematic conception of posterior membranes, tunica vasculosa or hyaloid sheaths; or cyclitic membranes. The illustration represents individual or combined opacities and obstruction to vision encountered in the author's practice. *D*, posterior hyaloid artery and occluding membrane accompanying partial cataract (postoperative schematic conception). This type of patient is usually blind in one eye and may be blind in both. The first step is quick removal of the lens by suction (the lenses are usually thin). After the operative hyperemia has cleared, the posterior opacity is revealed and the second step, by the curved knife and hook, is performed (see technic, Fig. 3). Such lenses are usually thin, and sometimes the posterior opacity can been seen on the table with the ophthalmoscope after the lens has been sucked out.

while it is blocking the filtration angle.

It is far better, and on the side of conservation of vision, to perform an iridectomy, with a disfigured pupil and a free drainage angle, than to run the chance of glaucoma by trying to avoid iridectomy. It is frequently a difficult question for the surgeon to decide, because cosmetic results are very important; but continued visual function is more important and must be given first consideration.

A family history of cataract or some other disease of the eyes was present in more than half of the cases here presented. Pregnancy may have been short or full term. A cataract at a more or less advanced stage was usually present. The lenses average much thinner than normal. The posterior membranous opacity is usually not seen until the lens has been removed, so that a diagnosis is infrequently made in advance of the first operation. If the baby is totally blind, it is advisable to operate at an age as early as 6 months. Differential diagnosis of the type of posterior membrane is difficult and often impossible. There may be a thickened plastic posterior capsule, an exudative cyclitic membrane or a hyaloid opacity present to obstruct vision. After the operative hyperemia has subsided, greyish white filaments or spangles are frequently seen in the vitreous by slit lamp examination. The color distinguishes these from ordinary

blood vitreous floaters. They are not threadlike and are not free in the vitreous but are attached, with one end floating free. I removed some heavy ones from an adult by the hook technic after cataract extraction several years ago. One eye softened and degenerated afterward, but the other still has fairly good vision.

Cases 4 to 17 inclusive, with their illustrations, indicate my experience with posterior membranes. The operations were largely of the nature of salvage, as there were many complications to be met. My line of reasoning is that if there is tissue obstructing vision it is incumbent upon me to try to clear the media, regardless of my inability to identify the membranous tissue beforehand. Performing iridectomies, opening membranes and removing scar tissue do not always result in a good-appearing eye. An iridectomy is, however, a great safety procedure when any kind of lens débris, tissue or exudate is present. If these exist and the surgeon works through a small pupil, he is never certain that drainage from the posterior to the anterior chamber is obtained, or that the filtration angle is free. If it is not free, hypertension may result, causing a slow, insidious noninflammatory glaucoma.

If there is a chance to clear the media and obtain useful vision by opening or removing any kind of obstructing membrane, I feel justified in operating on the basis of salvage. I do, however, have a clear understanding with the parents that I can promise nothing; such cases must be viewed from the standpoint that the child has everything to gain and nothing to lose. My results in these complicated cases are in the 50 per cent bracket.

*Treatment of Retinopathies.*—The mechanical removal of a cataract or the opening of an occluding membrane does not terminate the responsibility of the ophthalmologist. Except for the congenital zonular type, cataract is only one manifestation of a sick eye. In children especially, since nature has not completed the developmental process, there is frequently much that can be done to improve vision. One can often prevent or control inflammations and degenerative processes that would cause damage to the retina or the uveal tract. The ophthalmologist, the pediatrician, and the endocrinologist can

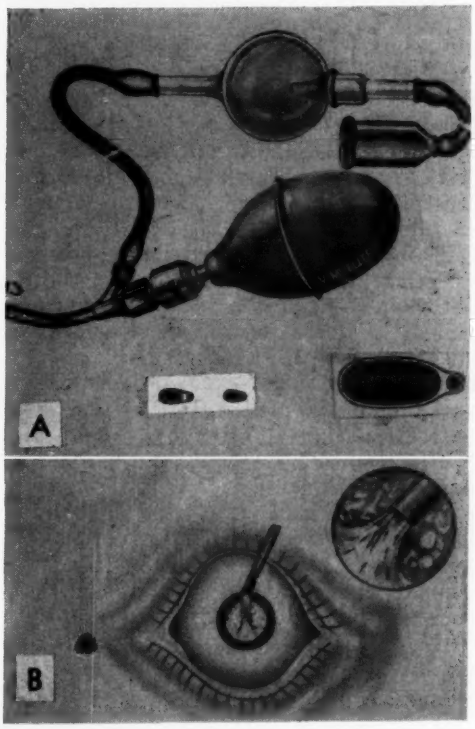



Fig. 2.—*A*, author's double cannula suction and lavage instrument. Briefly, it effects quick elimination of any soft cataractous lenses (either wholly or partly opaque) by oral suction.* This quick elimination of the cataract has greatly facilitated my early analysis of opacities of the posterior quadrant and of the vitreous. In cases of total soft cataract, suction is performed in one step after a capsulotomy with a Schweiger type forceps. In cases of zonular uncomplicated cataract, suction extraction is performed a few days after a classic needling. For an uncomplicated soft cataract with a well-dilated pupil, the results are well up in the 90 per cent bracket. In complicated cases, with small or poorly dilated pupils, synechiae, microphthalmus, etc., an iridectomy should be performed and, of course, the results have not been quite as good. *B*, double-barrel cannula inserted into the anterior chamber through a small corneal incision. The soft lens is aspirated through the large tube by oral suction. The anterior chamber is kept full of fluid injected through the small part of the cannula from the rubber bulb. The presence of the fluid in the anterior chamber greatly expedites the suction.

well cooperate in treating retinopathies in infants. In the average case, however, the treatment must be supervised by the ophthalmologist. The parents usually consider it an "eye case" and expect the "eye man" to deliver the treatment. The ophthalmologist must, therefore, be the key man in supervising and directing treatment through proper channels. There are many factors, both inflammatory and noninflammatory, to consider, but there are few tests that give definite indications for treatment. Hereditary conditions must also be studied.

The average baby ordinarily receives little attention for treatment of a retinopathy until much damage has been done. Unless a total cataract exists, demonstrated by a white pupil, the eyes, especially the fundus, are seldom seem early in life, as anesthesia is usually required for a good examination. The baby is usually about 6 months old before the parents note that there is defective vision. Crossed eyes may be noticed, but partial blindness may go without attention for a long time. Except in cases of congenital zonular cataract, retinopathies often accompany children's cataract. I therefore advocate early surgical removal (6 months) of total cataract, both to prevent amblyopia and to enable a retinopathy to be diagnosed and treated. Time is very important in the management of these developmental conditions. Much damage can occur that can never be undone by deferring treatment or surgical intervention beyond the early months of development.

Strabismus and nystagmus usually do not begin to appear for six months. The desirability of their prevention is another potent argument in favor of early operation for cataract. Exposure to sunlight is not harmful; there seems to be a basis, however, for the opinion of some ophthalmologists that exposure to fluorescent lighting may be harmful.

Much treatment of retinopathies has necessarily been empiric. Tests have been available for allergies, syphillis, tuberculosis, etc., but until recently there has not been much information on the baby's metabolic or endocrine processes. A tremendous amount of progress is being made by both pediatricians and endocrinologists.

It is becoming well established that human milk has never been excelled as baby

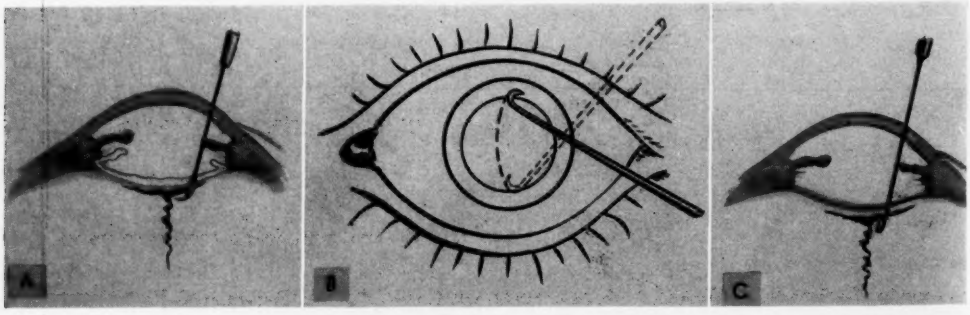



Fig. 3.—*A*, schematic illustration of the curved knife technic. The curved knife is employed after the lenses have been removed by suction and after the operative hyperemia has subsided. The knife penetrates the cornea and the posterior membrane and then makes a long clean sweep. If a good opening is obtained, the operation is terminated. If not, the author proceeds with the second step, i.e., the hook is used as in *B* and *C*. *B*, schematic illustration of the movement of the sickle-shaped hook knife through the posterior membrane. The cut shown follows an incision line from 6 to 12 o'clock but can be made in other directions. Frequently, the pupil is not as large as this, and not infrequently it is necessary to work through a ragged iridectomy following a keratome incision. *C*, optional step. If the sickle knife (*A*) does not effect a good opening, the blunt hook is introduced through the same small corneal knife opening. If necessary to permit insertion of the hook, the author enlarges the corneal opening slightly as he withdraws the curved knife. By so doing he keeps the corneal opening so small that vitreous seldom presents or escapes. The hook catches and tears an opening in the membrane, or removes a portion of it.

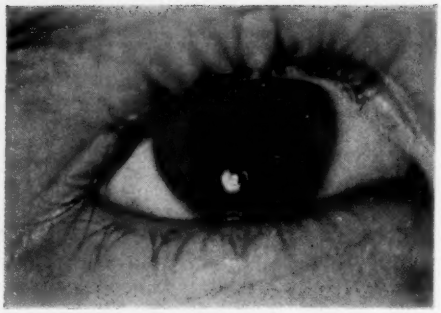


Plate 1.—B. N. of Kansas, a girl aged 6, blind before operation. Note heavy pupillary membrane. Vision in either eye, undilated, was 20/200. Dilation with atropine gave slightly improved eccentric vision.

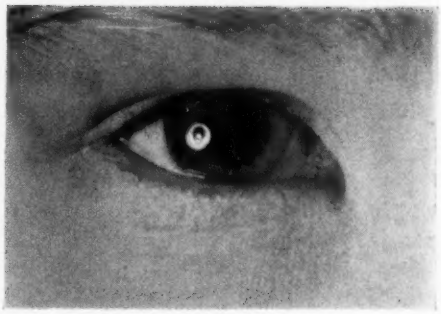


Plate 2.—Right eye of B. N. five days after the operation. Curved knife entered anterior chamber at limbus, followed by hook, at 12 o'clock. Pupillary strand first severed by alternate cutting and stretching, at 6 o'clock.

Plate 3.—Right eye of B. N. six months after the operation. Remnants of membrane still visible at pupillary margin, but center of pupil is clear and patient has normal 20/20 vision.

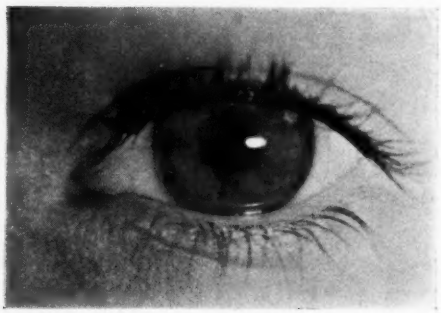


Plate 4.—Left eye six months after identical operation. Sclerotic remnant of membrane extends from nasal side toward pupil, but this does not interfere with normal (20/20) vision; unless it interferes later, further operation is not indicated.

Plate 5.—V. A. (Case 5), a boy born totally blind (see text). Curved knife and hook technic carried out ten days after extraction of cataract by suction (right eye). Cataract in left eye treated by suction at age of 1 year; also posterior membrane. Media cleared. Photograph taken at 13 months. With aphakic lens in helmet frame, child has normal (20/20) vision.

Plate 6.—C. W., aged 14, a pupil of the Colorado School for the Blind. Both eyes needled at age of 7. Right eye counted fingers at 15 inches; left eye totally blind (phthisis). In right eye, two layers of membranes, capsular exudating iris synechiae, posterior hyaloid. Two procedures with curved knife opened both membranes. Resulting vision, right eye, 20/30. Patient goes to regular school.

food. The pediatrician, endocrinologist and ophthalmologist encounter far fewer problems in treating the babies of nursing mothers. Even in the study of the retinopathies of prematurity, it has been noted that the well-nourished milk-fed baby fed on human milk often escapes the dreaded retrolental fibroplasia. Of course, retrolental fibroplasia does not develop in all artifically fed premature babies. I am convinced, nevertheless, that human milk feeding lessens the child's danger of retinopathies as well as many other developmental deficiencies.

Briefly, as regards treatment, I study the nutritional status and empirically give the same type of treatment to babies with retinopathies as I have observed to be beneficial to adults. Foreign protein therapy seems to have definite value. The endocrine glands are studied. The total blood protein or protein-bound iodine (P.B.I.) test gives valuable information on thyroid function. Thyroid and parathyroid are used as indicated and are of definite value. Iodides and minerals are also proving valuable. The endocrine tests are opening up great new frontiers in the treatment of retarded children. The role of the thyroid in structural development of the eyes and body is well known, and the results of the treatment are sometimes pronounced. Cretins, mongolian idiots, etc., heretofore considered hopeless, are reported as showing astounding improvement. Perhaps in the near future the endocrinologist may be able to test and treat both mother and child to prevent these retinopathies and general deficiencies. A tremendous field of study is presented for the physician with imagination and vision.

Preliminary care and treatment before operation are also very important. The coagulation test for persistent bleeding is especially to be considered, particularly if there are iris adhesions. Autohemotherapy has proved to be of distinct value for these bleeders. Early operation on both eyes to restore visual function is justified, to prevent strabismus and, especially, nystagmus. Visual training exercises may prevent further loss of vision and often produce improved retinal function. Training should be started as soon as the child is old enough to cooperate. Light exercises can be used with blind babies even a few weeks old, and are desirable before operation.

*Retinopathies of Prematurity (RL. F.) and Abnormalities of the Vitreous*: A differential diagnosis between fibroplasia (five stages) and hyperplasia and the other vitreous opacities (cysts, tumors)

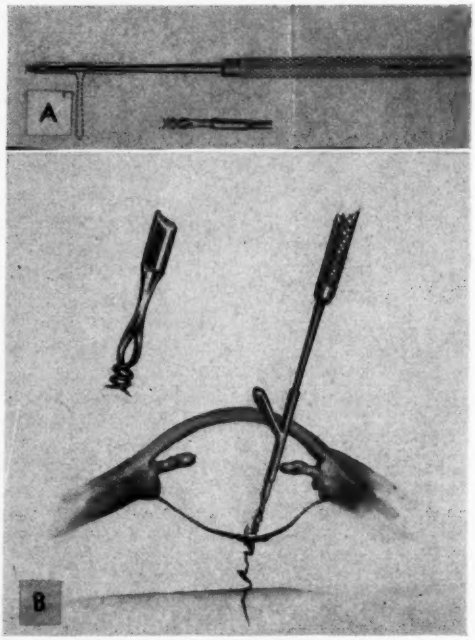



Fig. 4.—*A*, instrument maker's pictures of an experimental hook punch of the author's design. It has two opposite sharp prongs, so that once engaged in tissue it cannot be released. The author reports it with considerable reluctance and advises its use only when there are free filaments and fragments. *B*, experimental screw punch as the author used it. He passed it through a small keratome incision in the cornea. The sliding scabbard protects the iris from the points where it passes through the cornea. It was rotated to engage the tissue and punched out a hole in the membrane. It may also tear the membrane loose. It is a vicious instrument; it has been utilized in only 5 cases, and it is not yet recommended. The author has used it only in last resort salvage operations. He prefers making a cut through the membrane with a straight Wheeler knife as Reese does, or with his own curved knife.

is not easy, particularly in young infants with small pupils. The differential diagnosis is highly important, since the fibroplasia is not operable, while the hyperplasia may be. Neither fibroplasia nor hyperplasia should be confused with posterior types of cataract, but they frequently are. Little is definitely known as to the cause of the great increase in the number of retinopathies (RL.F.) among prematurely born babies. The evidence indicates, however, that oxygen, used and withdrawn rapidly, and nutritional deficiency are definite factors. A third phase, however, impresses me—that is, endocrine disturbances, particularly of the thyroid.

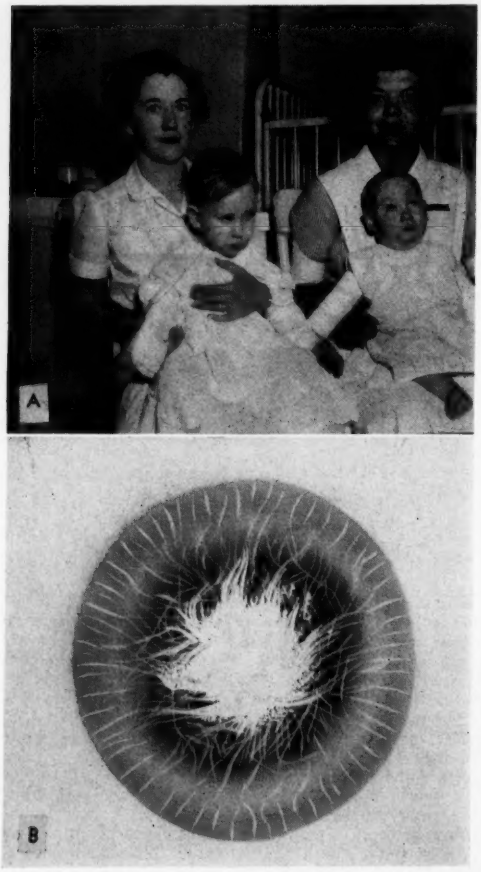



Fig. 5.—*A*, brothers R. O. and B. O. (Cases 2 and 3), totally blind before operation (see text). *B*, artist's composite picture of anterior pupillary and plastic membranes of all four eyes.

The Wolfe Cataract Foundation is now engaged in making the study of these retinopathies a research project, particularly from the endocrine standpoint. We have interested some other investigators, hoping that some information of value may be uncovered with regard to the nutritional and endocrine aspects of these retinopathies in both babies and mothers. We are experimenting with treatment, as part of the research project, in some of the early RL. F. cases (Stages 1, 2 and 3). As yet, however, there is no known treatment for this condition.

It is increasingly apparent that thyroid dysfunction, particularly hypothyroidism, exists with certain retinopathies. The role of the thyroid gland in retarded development and structural defects is well known, and it is proving to be just as important in eye conditions. With the tremendous increase of retrolental fibroplasia, it is time to begin a more thorough analysis of blood chemistry and thyroid function in pregnancy. Mothers who have had premature births or who are threatened with abortion should be studied. If a premature birth occurs, a study of blood chemistry and metabolism should be made on both mother and child. If the protein-bound iodine (P.B.L.) test for thyroid function reveals hypothyroidism, then early treatment should be considered in an effort to prevent or limit the retinopathies. Thyroxin fraction (Squibbs), iodides, fever and foreign protein therapy, minerals, vitamins, etc., in my experience have proved valuable. The role of malnutrition and oxygen seems proved, but nonetheless the glandular phase (particularly the thyroid), and the causes of uveitis should be considered early. If RL.F. is to be effectively treated, the earlier one starts the better the chances are of limiting its ravages. When the fourth or fifth stage is reached, treatment seems to be futile. Study of the blood chemistry at birth and consideration of preventive treatment offer the best chance. Both obstetrician and pediatrician should give patients with uveitis early consideration from the stand-

Fig. 6.—*A*, D. F., boy aged 7 months, totally blind (Case 4). *B*, same child one year after operation by author's curved knife technic.

point of prevention. The PBI test supplies a reliable index to the glandular treatment. Prevention of eye defects by early study and treatment by the obstetrician and pediatrician may be the keynote of one phase of the RL.F. problem.

## REPORT OF CASES

CASE 1. (Plate 1).—B. A. N., an attractive 6-year-old Kansas girl, had a heavy pupillary membrane almost completely obstructing the center of the pupil. Plate 1 (opposite Page 654) shows the right pupil dilated. The left eye was the same. With the pupils undilated the child's vision was 20/200 in each eye; this was slightly improved after dilation, but the vision was eccentric. A small keratome incision was made in the cornea at the limbus at 12 o'clock. The hook knife was inserted and passed through the anterior chamber in front of the membrane. The point of the curved knife severed the central strand at 6 o'clock. The blunt hook was then inserted and, by stretching and pulling the membrane, the other strands were broken.

Plate 2 shows the right eye five days after operation by the sickle knife hook technic. There was very little operative hyperemia, and the vision was immediately restored to 20/30. The right eye after six months (Plate 3) shows only remnants of the membrane at the pupillary margin, and the patient has normal 20/20 vision. The left eye after six months (Plate 4) shows a sclerotic remnant extending in from the nasal side toward the center of the pupil. It is not sufficient to interfere with the 20/20 vision, and reoperation will not be performed unless it does. The patient has single binocular vision of 20/20.

CASES 2 and 3.—R. O. and B. O., brothers, were totally blind before operation (Fig. 5*A*). The anterior chambers were almost absent in all four eyes. There were very heavy white sclerotic membranes completely obscuring the pupils, extending beyond the inner circle of the iris into the angle in all four eyes. They were diagnosed as pupillary membranes with prenatal plastic exudate. The membrane was so heavy in one boy's eyes that the iris could not be seen until after the first operation.

A composite picture (Fig. 5*B*) shows the artist's conception of the anterior pupillary and the plastic membranes of all four eyes before the operation. The membranes were opened with the hook knife technic and an iridectomy. Then a capsulotomy was performed with a Schweiger forceps, the synechiae being broken up and as much of the membrane and capsule removed as was possible. Thin, cataractous lenses were sucked out, after which posterior membranes of varying amounts were revealed in all four eyes. Fair openings were obtained with the hook knife technic. Both boys have useful vision, one boy in one eye only. One eye has since been reoperated on for the posterior membrane, and a good opening was obtained. Both boys are mentally below par. The younger has shown much improvement physically under treatment and demonstrates good vision with his cataract lenses.

CASE 4.—D. F., a healthy South Dakota boy aged 7 months (Fig. 6*A*) had been discovered to be totally blind at the age of 4 months. There was no family history of ocular disease. I performed a suction operation for removal of a soft cataract when the child was 7 months old. Two weeks after thin lenses were removed by suction, posterior membranes were observed in both eyes.

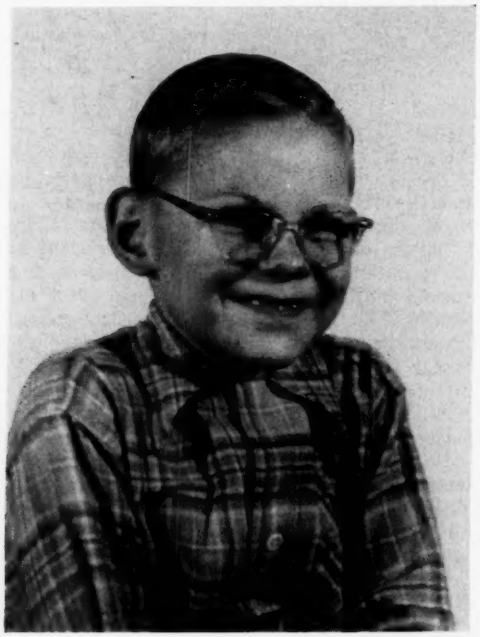


Fig. 7.—M. S. of Illinois (Case 6). This boy had a normal right eye, but the left eye had been blind since birth.

Fig. 8.—*A*, B. W. of Nebraska (Case 7), in whom posterior membranes were observed immediately after suction operation for cataract. *B*, H. M. Jr. of Tennessee (Case 8), who had a family history of ocular disease (see text).

Figure 6*B* shows the same child one year after the curved knife technic was used to open the undiagnosed posterior membrane. A good opening was obtained in the left eye and a fair opening in the right. Vision cannot yet be measured but is thought to be very good. The child wears his aphakic correction and reaches for small objects. Nine months later the parents reported his vision much improved.

CASE 5. (Plate 5).—V. A., of Kansas, born totally blind, was brought to me at the age of 10 months. A posterior opacity was discovered a few days after a total cataract had been sucked out. I removed the posterior membrane by the knife and hook technic. The referring eye specialist reports good vision with a plus 11.00 in a helmet (frame).*

CASE 6.—M. S. of Illinois, a boy 8 years old had a normal right eye and a left eye blind since birth. A posterior retrolental opacity was plainly seen at the first examination. The primary diagnosis was vitreous hyperplasia. A thin clear lens was first sucked out in the one-step procedure; then the sickle knife was used to cut a good opening through the posterior vitreous tissue. It has remained

*Since this paper was presented at New York, the left cataract was also operated on by the suction technic. A thin posterior membrane similar to that in the first eye (probably hyaloid) was encountered. It was also operated on by the curved knife hook technic. The media was entirely cleared. The boy now has estimated normal vision with his aphakic correction. Nine months later, he is still gaining in retinal function.

Fig. 9.—M. M. of Illinois (Case 9), born totally blind.

open and the patient has obtained a good visual result (Fig. 7*A*).

CASE 7.—The patient in this case was B. W. of Nebraska (Fig. 8*A*), whose father had complicated annular cataract. Posterior membranes were observed in both of the child's eyes immediately after cataracts were sucked out. He was very cooperative, and I was able to examine him well by the slit lamp. I diagnosed the opacities as opaque hyaloid sheaths. The sickle knife hook technic gave a good opening in these hyaloid membranes, and the child obtained 20/20 vision.

CASE 8.—The patient in this case was H. M. Jr. of Tennessee, a boy aged 7 (Fig. 8*B*). I have operated on his mother for complicated cataract and am treating her for a retinopathic condition. Both of the boy's eyes were operated on at the age of 7. Thin soft cataracts were sucked out. Posterior membranes were diagnosed soon afterward. I used the knife hook discission technic three times before a good central opening was obtained. The membranes were diagnosed as probably hyaloid or cyclitic by slit lamp examination. A positive differential diagnosis was difficult because of rapid horizontal nystagmus. The boy has a good central opening in the posterior membrane. He has obtained fairly good visual function in spite of considerable retinopathy.

Fig. 10.—*A*, N. D. of Illinois, born blind. *B*, photograph of N. D. taken two years after the operation.

Fig. 11.—*A*, L. R. of Iowa (Case 11), born blind. This girl was a pupil at the state school for the blind. *B*, C. W. of Colorado (Case 12), photographed before operation. (See Plate 6, opposite p. 654).

He attends a military school and maintains good grades. The rapid horizontal nystagmus has been reduced approximately 50 per cent.

CASE 9.—M. M., of Illinois, was born totally blind. The first eye was operated on when she was 15 months old, and the second eye four months afterward. Thin, partly opaque lenses were sucked out. They were not sufficiently opaque to account for the total blindness. Unidentified posterior membranes were discovered two weeks after the lenses were eliminated. The knife hook technic was employed and a good central opening obtained. Although this child is mentally retarded, she has good useful vision, picks up small objects and wears a +11.00 lens for each eye in a helmet-type frame without objection.

CASE 10.—N. D., of Illinois, a girl aged 18 months (Fig. 10*A*), was born blind. The left eye had light perception only and was chronically inflamed. Another surgeon had needled the left eye when the child was 9 months old. I found the right lens two-thirds opaque, and a posterior membrane was seen after the lens had been sucked out in the one-step procedure. The left eye was later reoperated on for a posterior capsule and membrane, probably cyclitic, and fair vision resulted. The sickle knife and hook technic was used on the right eye, with a good visual result. Another photograph (Fig. 10*B*) was taken two years after the operation. In the right eye the child's vision is estimated as normal (but unmeasurable). However, she identified small objects. The salvage operation (Fig. 3) was performed on the left eye. She obtained fair vision and a quiet eye. Nine months later the parents reported her vision as much improved.

CASE 11.—L. R. of Iowa (Fig. 11*A*), aged 7, was born blind. She came to me from the state school for the blind. The mother had had measles during pregnancy. Another surgeon had needled both eyes when she was 9 and 12 months old. She had partial seclusion of the pupils and neither had better than 10/400 vision. She had a rapid horizontal nystagmus. Both eyes had partly absorbed lenses; posterior, opaque (hyaloid or cyclitic) membranes were diagnosed on first examination. The one-

step operation was sufficient for both eyes. I used the knife and hook to cut the posterior membrane. The membranes opened well on the first operative step and she obtained good visual function in spite of a definite retinopathy. The marked nystagmus is much improved.

CASE 12.—C. W., a Colorado girl aged 14, was photographed prior to operation (Fig. 11*B*). She attended the Colorado School for the Blind. Both eyes were needled when she was 7 years old by another surgeon. There was profound formation of scar tissue in each eye. The right eye had finger vision at 15 inches before the operation. The left eye was phthisic.

The slit lamp demonstrated that there were three distinct layers of membranes. The first, anterior, was probably thickened, macerated anterior capsule and iris. There was much exudate and scar tissue, with heavy iris synechiae, but still an adequate opening. The second membrane was probably posterior capsule. The third posterior membrane could have been either cyclitic or hyaloid, or both. The schematic drawing (Fig. 12*B*) is an attempt to illustrate the situation of the three membranes. (The unusual clinical observation was verified by Dr. F. L. Wahrer). The sickle knife technic was used to open both occluding membranes in two procedures at one sitting, i. e., the knife was passed through the pupil opening of the anterior iris membrane, and the second, or the anterior, of the two occluding membranes was first opened. Then, without removal of the sickle knife, the second occluding membrane, or the posterior one, was opened and a central portion broken with the blunt hook. The girl obtained 20/40 vision, attends regular school and is fully rehabilitated.

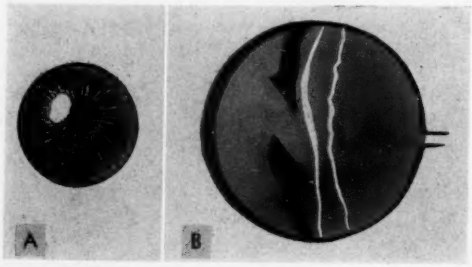



Fig. 12.—*A*, drawing of a 5 mm. sclerotic disc which was punched out and floated into the anterior chamber but has since been nearly absorbed. *B*, schematic drawing to show the situation of the three membranes in the case of C. W. (Case 12).

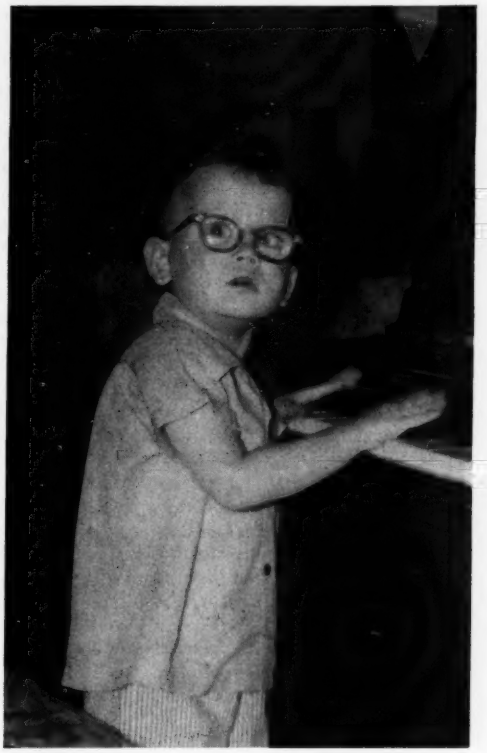


Fig. 13.—D. F. of Texas (Case 13). Total blindness was discovered when this boy was 8 months old.

Plate 6 shows the eye after surgical treatment. A later report says she has obtained 20/30 vision. She has been referred to a local oculist for refraction. Her mother says that she is a "new girl." I shall fit a contact lens soon.

CASE 13.—D. F. (Fig.13), a 3-year-old Texas boy, was found to be totally blind when 8 months old. I performed the suction technic and cleared the anterior media of a partly opaque lens. The lens opacities were not heavy enough to account for the total blindness. Two subsequent sickle knife and hook technic operations failed to open posterior membranes in either eye. The third operative procedure was with the screw punch and a fair opening was obtained in the membranes. In the right eye, a sclerotic 5 mm. disc (Fig. 12*A*) was punched out and floated into the anterior chamber but now is almost all absorbed. A lesser, but fair opening was obtained in the left eye. D. F.

has obtained good useful vision in both eyes. He is able to pick up small objects, rides a tricycle and indulges in most normal activities for a boy his age.

CASE 14.—K. McC. (Fig. 14*A*), a Missouri boy born totally blind and deaf, was 8 years old when brought to me. A double needling and a linear extraction had been performed by a competent ophthalmologist when the boy was 4. My examination revealed perception of hand movement at 2 feet. There was pronounced rapid nystagmus. The boy could be fully examined only under anesthesia. An extremely heavy membrane (2 layers) was diagnosed as cyclitic, hyaloid or both. I opened the membranes and cleared the media with the sickle knife and hook. In spite of an irregular pupil, the boy has clear media and good visual function. The photograph was taken one year after the operation. With greatly improved hearing (electric aid) and the good visual result, he has been completely rehabilitated. He goes to a special school, indulges in all activities and can read fair-sized print. He has a retinopathy, but this is improving under treatment, and he has useful vision—20/20 in the right eye and 20/70 in the left. The nystagmus has been reduced about 75 per cent (estimated). He rides a bicycle, plays the accordion and gets good grades in school.

CASE 15.—N. L., 8 years old (Fig. 14*B*), was a pupil at the South Carolina School for the Blind. There was micro-ophthalmus with total cataract. She had had two previous needlings in each eye, the first at the age of 1 year. In the right eye I first used the sickle-shaped knife to open the anterior membrane through a large iridectomy. I then sucked out some of the soft encapsulated lens. A posterior membrane was observed (in both eyes), which I opened with the knife. Solid sclerotic fragments were removed by forceps. In spite of a retinopathic condition (improving under treatment), the right eye has good visual function. The left eye was treated by a three-step procedure, the last for the posterior membrane before the media was cleared. Exudate tends to fill in again and may require further operation. The right eye has very useful vision and the left eye fair vision, but the two do not coordinate.

CASE 16.—R. McK., a three-year-old Michigan boy, had what looked like a typical hyperplasia as described by Reese. I opened it and removed a portion. The Army laboratory report stated that it probably was lens tissue. Clinically, I could see no resemblance to lens tissue.

CASE 17.—W. H., a 7-year-old South Dakota boy, was totally blind in the left eye, with a retrolental membrane diagnosed as vitreous hyperplasia. The right eye was not involved. Figure 15*A* shows the posterior hyperplasia before the operation. Figure 15*B* shows the

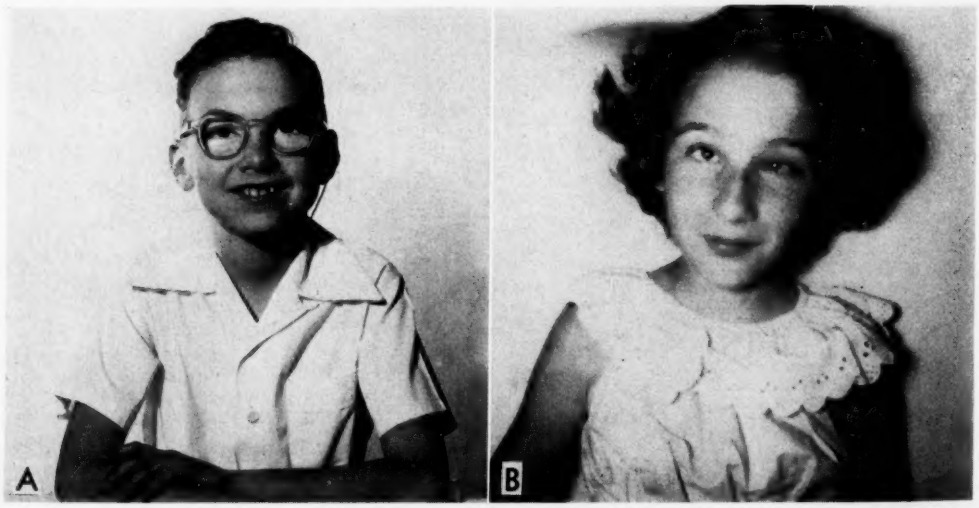



Fig. 14.—*A*, K. McC. of Missouri (Case 14), born totally blind and deaf. Photograph taken one year after operative treatment. *B*, N. L. of South Carolina (Case 15) who had microphthalmos with total cataract.

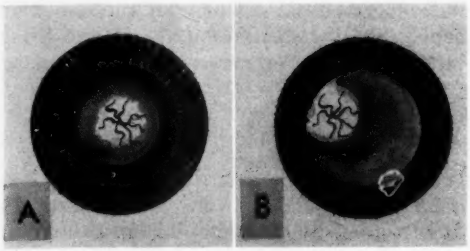



Fig. 15.—Drawings in case of W. H. (Case 17). *A*, posterior hyperplasia prior to operation; *B*, hyperplasia after suction removal of thin, clear lens.

hyperplasia after the thin clear lens had been sucked out. First, the lens was eliminated by being sucked out by my double cannula technic; then two attempts were made to open the membrane with the sickle knife and hook, but failed. The third time, the screw punch was used and the tissue all removed. The eye looked very promising for three days, after which a profuse intra-ocular hemorrhage occurred, was very slow in absorbing and resulted in vision of hand movement only. The eye was cleared, but the cornea is blood-stained and the case is considered a failure.

*Comment.* — I am strongly convinced that simple needling for juvenile cataract is an incomplete operation. If the eye is small or the pupil cannot be dilated, as in about half the cases, a needling alone is definitely contraindicated. If adhesions of the anterior capsule and iris are present, this is a major complication and calls for an iridectomy. The younger the child, the more frequently exudative scar tissue develops after needling, and subsequent poor results are obtained. This accounts for the fact that many surgeons have refrained from operating on babies. This objection, however, can be mostly obviated if the lens is expressed (by linear extraction) or sucked out, preferably the latter.

There are many arguments for suction removal of the lens. Space does not permit me to go into detail, but I consider a needling alone for juvenile cataract an obsolete procedure.

Opening occluding membranes to clear the visual media is "salvage surgery," but improved vision is obtained in 50 per cent of the children. These procedures are justified, provided the surgeon and the parents have a clear understanding beforehand.

## SUMMARY

Blindness in children resulting from developmental or exudative tissue in front of the lens or behind it (perilenticular) is discussed from the surgical viewpoint. Seventeen cases are illustrated both before and after surgical treatment. Color photographs are shown of one unusually heavy anterior pupillary membrane prior to and after operation. The cases of children with membranes or tissue, posterior to the lens, both anterior to the vitreous and within it are illustrated from the surgical point of view.

Differential diagnoses are not always made prior to surgical intervention, particularly if the lens is partly cataractous. In the developmental type of membrane in the cases here reported there was a common denominator; i. e., the lenses were smaller than the average.

Lens removal by the author's lavage suction instrument was performed prior to

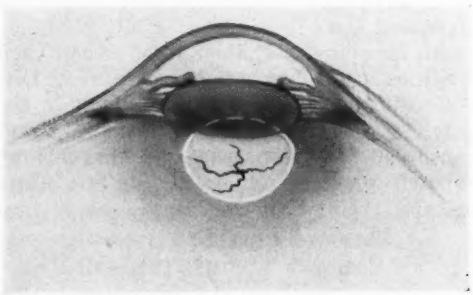


Fig. 16.—Schematic illustration of a typical hyperplasia of the primary vitreous (Reese) and also as the author conceived it from his surgical experience. Vitreous hyperplasia ordinarily involves only one eye, but it man involve both. The lenses are usually thin and partly opaque but may be entirely clear. The vitreous hyperplastic membranes have distinct margins. There is usually a nest of blood vessels. If there is a history of short-term pregnancy, it is difficult to differentiate from fibroplasias, especially if both eyes are involved and the lenses are not clear. Unless the differential diagnosis from retrolental fibroplasia could be made, the author has not resorted to surgical intervention.

any operation on the posterior lenticular tissue, affording quick elimination of the cataractous lens (part or whole). As compared to the slow elimination of the lenses from needling alone, suction removal quickly affords a clearing of the media in front of the tissue and facilitates a quicker differential diagnosis.

Posterior capsular membranes in aphakia were usually not as great a problem unless tension was encountered. Hyaloid or vitreous tissue, however, was encountered in several cases. The differential diagnosis of capsular from cyclitic or exudative or hyaloid membrane was not always possible. An effort was made, nevertheless, to clear the media surgically, and improved vision was obtained in approximately half of the cases. Several unsuspected posterior membranes were discovered after removal of cataractous lenses.

In cases of the true zonular type of cataract no posterior lenticular membranes have been encountered. In cases of zonular and other types of uncomplicated juvenile cataract, the results with the author's suction technic are in the 90 per cent bracket.

Hyperplasia of the vitreous is not infrequent, and it is rather easily confused with fibroplasia. It should not be confused with cataract, but this has occurred. Differential diagnosis is more difficult in the early stages if the pupils are small. Diagnosis is very important, as there is no known surgical treatment for the fibroplasia.


RÉSUMÉ

L'auteur continue dans cet article une série d'études sur la chirurgie des membranes périlenticulaires chez l'enfant. Plusieurs cas à l'appui. L'auteur décrit son procédé chirurgical du traitement de la cataracte de l'enfant et insiste sur l'importance de la vision maintenue. On doit nécessairement viser à un résultat cosmétique, sans toutefois sacrifier la fonction visuelle.

L'auteur discute aussi de certaines pathologies de la rétine et d'anomalies du corps vitré. Il insiste sur le diagnostic et le traitement précoces de ces affections.

ZUSAMMENFASSUNG

Die vorliegende Arbeit über die chirurgische Behandlung von perilentikulären Membranen bie Kindern ist ein Stück aus einer Reihe von Artikeln des Verfassers über die ophthalmologische Behandlung kleiner Kinder. Es wird über zahlreiche Fälle mit erläuternden Einzelheiten berichtet. Der Verfasser beschreibt seine Technik der Operation des jugendlichen Stares und betont die überragende Wichtigkeit der Erhaltung der Sehkraft; wenn auch gute kosmetische Resultate höchst wünschenswert sind, so müssen doch die funktionellen Ergebnisse, wenn beides nicht erzielt werden kann, den Vorrang einnehmen. Der Verfasser hält die einfache Nadelung für eine unzulängliche Operation zur Behandlung des jugendlichen Stares.

Die Behandlung von Netzhauterkrankungen und von Anomalien des Glaskörpers wird ebenfalls erörtert; dabei wird die Bedeutung einer frühzeitigen Erkennung dieser Erkrankungen hervorgehoben und die Wichtigkeit der Vorbehandlung von Kindern, die zur Operation bestimmt sind, betont.

RESUMEN

Se presenta la terapeútica quirúrgica de las membranas perilenticulares en el niño, continuación de una de la series de artículos del autor sobre el tratamiento oftalmológico en la infancia. Se comunican é ilustran en detalle numerosos casos. Se describe la técnica quirúrgica del autor para la catarata juvenil, haciéndose notar la marcada importancia de la preservación de la función visual; aun cuando es muy deseable un buen resultado cosmético, debe de darse preferencia al resultado funcional si no pueden ser obtenidos ambos resultados. El autor considera al "agujamiento simple" como una opera-

ción inadecuada para la catarata juvenil.

Se discute también el tratamiento de los padecimientos de la retina y las anormalidades del cuerpo vítreo, con énfasis sobre la importancia del reconocimiento temprano de estos padecimientos y sobre el tratamiento de niños en los que ha de realizarse la operación.

RIASSUNTO

Gli Autori presentano, in continuazione alla loro serie di articoli sul trattamento oftalmogico nei giovanissimi, la terapia chirurgica delle membrane perilenticolari nei bambini. Vengono riportati e dettagliatamente illustrati numerosi casi. E' descritta la tecnica operatoria usata dagli Autori per la cataratta giovanile e sottolineata l'importanza della continuazione della funzione visiva; benchè il risultato estetico sia molto importante, purtuttavia qualora non possano ottenersi entrambi, viene data la preferenza al risultato funzionale. Gli Autori considerano che nella cataratta giovanile la semplice perforazione sia un trattamento inadeguato.

Vengono anche discusse le anormalità del cristallino e il trattamento delle condizioni retinopatiche; sottolineata inoltre l'importanza di una diagnosi precoce e le cure preliminari nei bambini che dovranno poi essere sottoposti ad intervento.

Perfect bravery and thorough cowardice are two extremes which are seldom reached. The space between the two is great, and comprehends all other kinds of courage, between which there is as much difference as between countenances and dispositions. There are some men who expose themselves readily at the commencement of an action, and are disheartened and discouraged by its duration; some are content as soon as they have satisfied their reputation with the world, and do very little beyond this. We see some who are not at all times equally masters of their fears; others suffer themselves to be carried away by general panics; others go to the charge because they dare not remain in their posts. We find some in whom an acquaintance with petty dangers strengthens their courage, and prepares them to expose themselves to greater ones. Some are brave when sword in hand, and yet dread the fire of musketry; others are steady under fire, and fear the sword. All these different species of courage concur in this, that night, by augmenting fear and concealing good or bad actions, gives the privilege of being discreet. There is another species of discretion which is more general, for we never see a man perform as much in an encounter as he might do if he were sure of coming off safe; so that it is evident the fear of death subtracts something from courage.

—*La Rochefoucauld*

# *Editorial*

## Custis Lee Hall Memorial Lecture, 1953

### Surgical Complications of Diverticulosis

CHARLES S. WHITE, M.D., F.A.C.S., F.I.C.S.

WASHINGTON, D. C.

WHEN reliable statistics record that 8 per cent of persons over 50 years of age have diverticulosis of the large intestine, that 12 per cent of those with diverticulosis will have an attack of diverticulitis, and that 1 in 5 of those with diverticulitis will require surgical intervention, it must be conceded that diverticulosis has surgical implications. "Since 1900 the population of the United States has doubled, but the number of persons forty-five to sixty-four years has tripled, while the number sixty-five years and older has quadrupled. There are now (early 1952) thirteen million men and women sixty-five years and older. This number is increasing currently at the rate of 400,000 a year."[1] With such a prospectus, colon surgery shows no signs of diminishing.

Diverticulosis is a pathologic lesion but not necessarily associated with clinical manifestations. Several interesting observations and theories have been advanced in respect to the etiologic aspect of diverticulosis, but, since they remain in the realm of speculation, discussion will be omitted. It is a relatively common condition, frequently without local or constitutional symptoms, but subject to a variety of complications.

The types of acute diverticulitis do not follow a formal pattern and may terminate in one of several ways; namely, by resolution, localized abscess, perforation into a contiguous organ, perforation and diffuse peritonitis, or obstruction of the colon. All of these complications are surgical either potentially or actually. Complications may be expected in 10 to 20 per cent of cases of acute diverticulitis.

The milder types of diverticulitis are prone to terminate in resolution, are usually treated by the internist or the gastroenterologist and respond well to rest, restricted diet and sedation.

In the presence of obstruction secondary to diverticulitis, the cause is not always evident unless the patient has been under observation for a fairly long period and has had roentgen examinations of the colon. Differentiation between carcinoma and diverticulitis can be difficult and even impossible, but some general dissimilarities are recognized. Although the two conditions occur in the same age group, diverticular obstruction is rarely attended with bleeding; the constitutional effects, such as loss of weight, anemia, and weakness, are less evident, and the roentgenologist will point out marked differences on the film. Then, by the double contrast enema, there seems to be a distinct pattern for each—with carcinoma the overhanging edge is sharply defined, while in the presence of diverticulitis the edges about the diverticulum are rounded or rolled over.

From the Research Foundation, Doctors Hospital, Washington, D. C.

Presented as the Custis Lee Hall Memorial Lecture, Eighteenth Annual Congress of the United States and Canadian Sections, International College of Surgeons, New York, September, 1953.

1. "Fact Book in Aging"; Federal Security Agency, Committee on Aging and Geriatrics: 1952.

It is very doubtful whether there is a causal relation between diverticulosis and carcinoma, but the presence of both in the same area is not rare, and it should not be forgotten that they may coexist in separate areas in the colon.

Even at operation the similarity between carcinoma and obstructing diverticulitis is striking, and on occasions only microscopic examination furnishes the answer. In those indeterminate cases, the radical operation for cancer is the logical treatment. The surgical treatment of diverticular obstruction depends on its extent or acuteness, and in the presence of total obstruction the obvious procedure is decompression of the bowel, preferably in the transverse segment. The use of the Miller-Abbott tube is a waste of valuable time as a substitute for operation. The acute obstruction is often the sequel of a chronic lignous inflammation of the bowel, and although relief may be afforded by aspiration decompression, it is strictly transitory. A colostomy reduces the tension in the bowel at once and permits the use of irrigation and antibiotics in the affected area. After a comparatively brief period the patient can be prepared for a radical operation: this should consist in removing the involved segment and performing an end-to-end anastomosis.

In the presence of incomplete obstruction, when it is possible to empty the bowel by laxatives and enemas, an elective operation is possible and should be undertaken after the patient is amply prepared by liberal fluid intake, perhaps transfusions and selective antibiotics. The Miculitz operation is obsolete, being an appeasement procedure. A proximal colostomy is unnecessary. There is no greater risk in resection for chronic obstructing diverticulitis than for carcinoma of the sigmoid, and the recommendation of preliminary colostomies seems to be harking back to the pre-Lister days.

Perforation of a diverticulum is not always catastrophic, and it may follow any one of three courses: In the mildest or most attenuated type the diverticulum has probably existed for a long period, and about its pericolonic area there has been sufficient inflammatory reaction to provide a firm wall of adhesions. When a perforation occurs, the contents of the diverticulum are held within bounds by the laminated inflammatory wall which has preceded the rupture. The symptoms are mostly local, consisting of pain in the left flank, tenderness and the suggestion of a mass. The systemic reaction is mild, consisting of slight fever and malaise, with pain referred to the sigmoid region. Under rest, restriction of food, and treatments with antibiotics, such as pencillin, streptomycin, or terramycin, the symptoms usually subside. Recurrences are not uncommon.

A more serious sequela of perforation or rupture is an abscess, usually attended by graver symptoms which are likened to those of acute appendicitis and often termed left-sided appendicitis. In these cases the onset is more acute, there has been little opportunity for local reaction, and the contents of the diverticulum are expelled into the adjacent area. Fortunately, in the majority of cases, there is sufficient protective reaction to limit contamination and reduce it to an abscess. The signs and symptoms of an abscess in this area need no elaboration, as it is almost self-evident, but without a history or knowledge of pre-existing diverticulitis the diagnosis of ulcerating carcinoma must be considered a possibility. Irrespective of the cause, the treatment is surgical.

Drainage of the abscess is imperative, and if it can be accomplished by an extraperitoneal approach so much the better, but this is the exception rather than the rule. Only when the mass lies lateral to the colon is it possible to evacuate it without invading the peritoneal cavity. It is usually necessary to open the abscess by the most direct route, which requires invasion of the peritoneum. If the abscess is encompassed by a firm inflammatory wall, ample drainage will insure recovery —with the possibility of a fistula. Any attempt to close the communication with the bowel is usually doomed to failure, although a patch of omentum or epiploiea

may be utilized for the purpose. Recourse to a transverse colostomy is rarely necessary to divert the contents of the colon from the sigmoid area unless an obstruction is also present. It is difficult to visualize any condition in the presence of an abscess that would warrant resection of the diverticulum-bearing area of the colon. This should be postponed.

Perhaps the most infrequent, but at the same time most critical complication, is that in which no extracolonic adhesions have been established; with the rupture of the diverticulum, the contents of the bowel pour unobstructed through the rent and spread over the organs of the peritoneal cavity. The onset gives little or no warning; it is preceded, perhaps, by vague and minor symptoms, but is marked by a suddenness and intensity that can be compared only with that of acute pancreatitis or perforation of a peptic ulcer, which it simulates in some respects. In the course of a few hours all the evidence of diffuse peritonitis appears, with few or no clues as to its origin, except on the basis of a reliable previous history. The precipitous onset, shock, distention, rigidity, pain and vomiting do not permit or require a time-consuming study. A flat roentgen film of the abdomen often serves to clarify an otherwise obscure diagnosis.

The treatment is strictly surgical, and no time should be lost in opening the abdomen, as the mortality rate advances at an estimated 4 per cent per hour. Localization of the perforation is not difficult, but satisfactory closure is often quite impossible. A tube may be sutured into the perforation and the colon drained directly, and in addition a transverse colostomy performed to divert the fecal contents. Thorough aspiration of the abdomen should be done rapidly, and a tube or two should be inserted and connected with a sump pump. A Levine tube and Wangenstein gastric drainage are imperative. Intravenous fluids, 3000 to 4000 cc., are needed daily. These should be reinforced by adequate antibiotics, to which may be added vitamins. Transfusions of blood or Dextran or both have an important place in the postoperative treatment. The final treatment, after the acute phase has passed and a fistula is present, may be postponed a month or two, depending on several factors not necessary to enumerate. Let it be said again that, in the presence of perforation and diffuse peritonitis, temporizing is hazardous and only immediate operation should be considered. Regardless of the treatment, the mortality rate is formidable. The possibility of the perforation of an ulcerating carcinoma must always intrude itself and cannot be ignored.

It is fortunate that all perforations are not acute, as extracolonic reaction prepares the area for the event; consequently a contiguous segment of a bowel or the bladder becomes adherent to the colon in the immediate vicinity of the inflammed diverticulum, and by perforation a communication is established between the sigmoid and the bladder or a loop of bowel. The bladder is often the innocent bystander, more frequently in the male, as the uterus proves to be a valiant defender in the case of the female. The early stage of this perforation is announced in the usual manner; pain, fever, local tenderness and leukocytosis. In a day or two dysuria develops, which is highly suggestive of involvement of the bladder, and the suspicion becomes a reality when the patient voids with the hissing sound of air and the urine is foul and contaminated with the particles food. A barium enema will disclose the approximate location of the perforation of the sigmoid without indicating the actual tract of the fistula. The barium will not follow the course of the artificial canal, as it is usually narrow, irregular and short. A cystogram will show the deformity of the bladder and the site of the fistula, but again the opaque fluid will rarely pass into the bowel. A cystoscopic examination will not leave the diagnosis in doubt. The fistulas do not heal spontaneously, and only surgical measures offer permanent relief. It seems to be the general practice to divide the operation into two or three stages requiring many months to complete, but this

treatment has been outmoded by preoperative preparation, more skillful surgical technic and better anesthesia.

With four or five days of preparation, low residue and liquid diets, laxatives and enemas, sulfathaladine or a similar-acting sulfon, virtual sterilization of the contents of the bowel is possible, permitting a one-stage operation. The involved portion of the sigmoid is liberated by careful dissection and resected, and an end-to-end anastomosis is completed. A colon tube should be passed from the rectum through the anastomosis and maintained by suturing the tube at the anal margin. The opening in the bladder is closed and an indwelling catheter left in place five days. Such an operation carries no more risk and is no more difficult than is resection of the sigmoid for carcinoma. Just why a preliminary cystostomy or colostomy or both should be done, with a waiting period of several months, is inexplicable; it does not seem consistent with the present-day conception of colon surgery.

Fistulas between the sigmoid and other segments of the intestinal tract can be treated in the same manner. Some of the fistulas have unpredictable and unknown courses, and their ablation may require meticulous surgical attention.

A rare complication of diverticulosis is hemorrhage. It is believed that bleeding is an uncommon symptom of this disease, being rather associated with carcinoma; in fact, it is pointed out as a differential sign or symptom. A few cases of severe hemorrhage occurring as the result of diverticulitis have been reported, and when it is not arrested by the usual medical means a major operation may be required.

Quinn and Ochsner[2] report that 76 patients with diverticulitis were admitted to the Charity Hospital, New Orleans, in the past ten years for complications of diverticulosis or diverticulitis of the colon; of these 37, or 48.7 per cent were admitted primarily for hemorrhage. At the Doctors Hospital, Washington, D. C., from 1940 to 1952 inclusive, 104 patients with diverticulitis were admitted, and of these only 14 had hemorrhage as a major symptom.

In the course of all major operations some unpredictable events transpire. In connection with diverticulosis there is one accident which may be a matter of grave concern—perforation of the diverticulum by the barium enema. This may consist of a mere trickle through the rupture or a large quantity may escape. It is surprising how little reaction follows contamination by barium, and it has been my plan to hospitalize the patient at once, give penicillin and streptomycin, clear liquids and absolute bed rest. The two patients I have had occasion to observe have not required operation, but this is no precedent in favor of nonoperative treatment; it is mentioned merely to express the opinion that conservative treatment may have its reward.

Lewis and Hurwitz[3], referring to diverticulitis, observe that a surgical laissez-faire attitude has permeated medical teaching. According to them, "very little impetus has been given to surgical excision of the diseased segment of the bowel, despite a high morbidity and a high recurrence rate associated with measures other than surgical." They condemn the attitude of "Let's wait and see", and urge earlier surgical intervention, with wide resection of the diseased segment and the redundant sigmoid as the ultimate goal.

Ransom[4], in discussing the surgical treatment of diverticulitis, made this comment: "A considerable number of the patients for whom resection was performed had had chronic perforation with cutaneous bladder, internal fistulae, or small parasigmoidal abscess. In many of these a three-stage operation procedure, consisting of (1) transverse colostomy, (2) resection with anastamosis, and (3) closure of the colostomy was performed.

2. Quinn, W. C., and Ochsner, A.: Bleeding as a Complication of Diverticulosis or Diverticulitis of the Colon, Am. Surgeon 19:397-402 (May) 1953.

3. Lewis, J. D., and Hurwitz, A.: Surgical Treatment of Diverticulitis, Surgery 33:481-494 (April) 1953.

4. Ransom, H.: Surgical Treatment of Diverticulitis of Colon. Read at a meeting of the American Gastro-Enterology Society, Atlantic City, May 1953.

There were no operative deaths in this group. However, when one considers the long hospital sojourn and the weeks or months of colostomy life, it is evident some simpler form of management is desirable. Since perforation represents the origin of the aforementioned complications, it is suggested that segmental bowel resection in certain cases of chronic relapsing diverticulitis of the sigmoid or descending colon is not only a justifiable but actually a conservative precedure. The low mortality rate now reported for resection of the colon for carinoma affords convincing proof that such a procedure can be carried out and the risk of which is almost negligible." I am in complete accord with this statement.

---

When Semmelweiss in 1846 came to Vienna, as an assistant in the obstetrical clinic, the old medical school was in its heyday. The stethoscope and the microscope had come into their own, and in medical circles it was the diagnosis that counted and not the treatment. Physicians in their enthusiasm for these new instruments of diagnosis forgot that they should sometimes cure patients. "What medicine shall I take?" the patient often asked the doctor. The Viennese physician, a little startled at the question, shrugged his shoulders and replied: "Oh, that's immaterial." One of their most noted professors said publicly: "The physician should be judged by the extent of his knowledge and not by the number of his cures."

The Viennese school of that period has often been called the school of "therapeutic nihilists," a rather formidable-sounding epithet. Translated into simple English, it means that they did not believe in treating their patients. Time, however, has mellowed somewhat the resentment once felt against them, and the more charitable verdict would be that, while they went to extremes in their views, their whole attitude was a natural and perhaps wholesome reaction against the widespread and indiscriminate overdrugging of the sick.

*—Ralph H. Major*

# New Books

**Current Therapy, 1953.** Edited by Howard F. Conn.

As in the previous volumes of this series, an attempt is here made to make available to the physician the literature on new drugs and methods of treatment. Each of the authors, 209 of whom are new contributors, is considered an authority in his field. Although this edition stresses new therapy, it gives the present-day standard procedures, whether new or of long standing.

The book is a well organized, comprehensive compilation of pertinent information. Of special interest are the chapters that discuss parenteral fluid therapy and diabetes mellitus.

Section 4, dealing with diseases of the blood and spleen, is particularly well done. It might have been well in this section to include secondary hypersplenism.

This book can be recommended as a digest form of current therapy.

PHILIP THOREK, M.D.

**Epilepsy and the Functional Anatomy of the Human Brain.** By Penfield and Jasper.

Drs. Penfield and Jasper have condensed into 896 pages the most complete summary of functional anatomy of the human brain, as approached both from the laboratory point of view and from clinical studies of the epileptic patient, yet compiled between the covers of one book. They state that their aims were twofold, the primary one being clinical and the secondary one scientific. They have successfully accomplished their objective. Dr. Penfield's several decades of meticulous studies on epilepsy are known throughout the world. Of no less importance are Dr. Jasper's contributions to electroencephalography and neurophysiology since he joined the Montreal Neurological Institute in 1938.

The nineteen chapters, each separately written by one or the other of the authors, cover the entire subject in detail, both from the clinical and the scientific aspect. A wealth of material has been amassed in these chapters and is readily available with the aid of a fairly adequate index. The illustrations are refreshingly new, clear and satisfactory. There are eight Kodachrome reproductions in full color. The book is well printed, in type easily read, and is surprisingly free of typographic errors.

Of interest to many will be Chapter 8, "Results of Excision," in which the authors have given details that many have waited long to see and for which they have been so critical of the Montreal group.

A review of the tabular figures in Chapter 18 concerning the end results of excisions and of meningocerebral cicatrix, areas of **simple** cortical atrophy and temporal lobectomies, is most encouraging. About 50 per cent of patients may be considered "cured" and over 20 per cent improved. This is a much better record than has previously been recorded. It is to be emphasized that these figures refer to patients operated upon for proved lesions and do not refer to the vast group of epileptic patients whose lesions (?) are diffuse or not demonstrable and hence not amenable to surgical treatment.

This masterpiece will find its way, through its own excellence, to the library shelf of every serious student of neurology, neurosurgery, neurophysiology and kindred sciences.

KENNETH H. ABBOTT, M.D.

**Copying and Duplicating Medical Subjects and Radiographs.** By K. Lou Gibson. Rochester, N.Y.: Eastman Kodak Company, 1954. Pp. 80, with 37 illustrations.

In this monograph are described the details of copying roentgenograms, slides, negatives, transparencies and colored drawings. After outlining the preliminary technics, the author discusses the copying of black and white originals, describing the equipment (camera, supports, retention devices, lights, etc.), films and exposure, together with processing and criteria for judging quality. Corrective measures are also detailed, and the formula for their use is in the appendix.

Contact and reflex copying are also outlined. Filters are described, and special methods noted for copying the color transparency for motion pictures in black and white. This is an excellent handbook for any doctor interested in any phase of photographic, roentgenographic or cinematographic reproductions.

The author is a technical editor associated with the Eastman Kodak Company, and the work is based on experience. One needs very little technical knowledge to make a better reproduction with the aid of these instructions.

JEROME J. MOSES, M.D.

**The Psychiatrist: His Training and Development.** Report of the 1952 Conference on Psychiatric Education at Cornell University. Edited by John C. Whitehorn and John McK. Mitchell. Washington, D. C.: American Psychiatric Association, 1953. Pp. 214.

The editors have done an admirable job of rendering a forthright, clear and easily readable survey of this unique conference. For the first time a serious attempt was made to delineate some areas of agreement between the different psychiatric doctrines and feuding psychotherapeutic sects, without, however, denying the still existing diversity of opinions in many essential aspects. It is now universally agreed that the development of a competent psychiatrist requires an understanding of the personality in terms of dynamic concepts. By psychodynamics is meant the systematized knowledge and theory of human behavior and its motivations. A fundamental postulate of psychodynamics is that most of the significant activities of human beings are motivated and goal-directed, and, while a person may be explicitly aware of some of his motivations, a great deal remains implicit or perhaps quite unconscious. Rational psychotherapy is based on the assumption that the motivation of behavior can be discerned and understood by specific psychologic methods and procedures, and are accessible to interpretation. Such interpretation requires experience, training, imaginative talent and critical judgment. Freund, Adler and Jung differ in the importance they attribute to sex, hunger and power motives, and the individual psychiatrist's philosophy and personal bias determine his frame of references. In spite of full recognition of Freud's important contribution which Freud has made to psychotherapy, the monopoly that the psychoanalytic groups tried to establish in the training of psychiatrists has been broken by the following remarkable statements.

With full recognition of the importance of Freud's contribution to psychiatry, the monopoly that psychoanalytical groups have tried to establish in the training of psychiatrists has been broken by the following remarkable statements at this conference:

"1. It is not necessary to be psychoanalyzed in order to develop competence as a psychiatrist, including competence in psychotherapy and psychodynamics.

"2. It is highly desirable that some persons should receive a personal psychoanalysis and psychoanalytic training . . . For those who are to practice the specialty of psychoanalysis, such psychoanalytic training is a necessity."

ERNST HAASE, M.D.

**Regional Block: a Handbook for Use in the Clinical Practice of Medicine and Surgery.** By D. G. Moore. Springfield, Ill.: Charles C Thomas, Publisher, 1953. Pp. 392, with 262 illustrations.

This book is an outline of the most common procedures for regional block. The purpose of the author is to give a description of one technic for each block, in order to avoid the switch from one approach to the other after the first unsuccessful attempt.

The book should be of interest to the beginner and serves a useful purpose in emphasizing the need for special skill in one technic rather than less exact knowledge of many different approaches. For the experienced anesthesiologist who has already made his own choice, this book will be helpful only when the technic described in the text is his favorite one.

The type is clear; the paper is of excellent quality; the illustrations are in black and white, and most of them give an accurate picture of the regional anatomic relations. This book should not be considered a substitute for a more complete textbook, but it is recommended as a useful guide for the beginning anesthesiologist as well as for the general practitioner.

OSCAR A. RIVERA, M.D.

**Diagnosis of Acute Abdominal Pain.** By William Requarth. Chicago: The Year Book Publishers, Inc. Pp. 243, with 79 illustrations.

This well-written book is an admirable presentation of a topic that is difficult to discuss. Although the subject of differential diagnosis of acute abdominal disease is old it continues to offer an annoying challenge to anyone interested in diagnosis. A fresh and unconventional presentation is a wel

come addition to the library of any physician.

The author correctly emphasizes erroneous interpretation of indications for surgical intervention. He avoids classifying diseases according to diagnosis based on probability or purely on the pathologic picture; instead, he prefers to classify the conditions as to the exigency of treatment.

The first part of the book deals with intestinal obstruction; numerous and pithy examples of the various diagnostic patterns are included. The second section expounds those acute diseases of the abdomen which are classified as to urgency of therapy. The chapters dealing with acute abdominal pain following trauma, abdominal pain in infancy, and gastro-esophageal hemorrhage are especially well written; indications for operative intervention are included. Chapter 6 discusses those diseases for which operation is contraindicated or harmful and is particularly well documented.

This succinct work can be recommended unreservedly for anyone concerned with the diagnosis of acute abdominal pain.

PHILIP THOREK, M.D.

**La Apendicitis en la Infancia (Appendicitis in Childhood).** By L. Gulbern Salisachs. Publicaciones Medicas, José Ganés, Editor. 1951.

A highly practical and accessible book, dealing with the seriousness of appendicitis in childhood, with special reference to the various and sometimes complex problems of differential diagnosis. Attention is given to the appendiceal physiopathologic background. Several observations, valuable for a perfect clinical and surgical knowledge of appendicitis in childhood, are presented. This is indeed a most valuable compendium for those who are concerned with the important problem of this disease.

VIRGILIO A. DE CARVALHO PINTO, M.D.

**Contributions from the Pathologic and Surgical Institute of the University of Padua.** Edited by V. Pettinari. Padua: Pathological and Surgical Institute, University of Padua, 1951.

To call this merely a book would be misleading. In reality, it is a compilation of manuscripts and articles abstracted from Italian medical journals and published in the form of a book edited by Professor Pettinari, who is the director of surgery at Padua University. All of the articles are well written and appropriately illustrated by charts, roentgenograms, drawings and pertinent photomicrographs. The articles number 42 and have been written by approximately 13 authors. The publications constitute a wealth of experimental and research contributions emanating chiefly from the pen of Professor Pettinari and his extraordinary assistants and associates in Padua University in 1951 to 1953 inclusive.

No one should judge this book by its cover, as the binding is not too attractive. This reviewer is convinced, however, that its contents are monumental pieces of original research in such subjects as: Dysplasia of the ampulla of Vater, idiopathic mega-esophagus, pneumomediastinal studies of blood vessel pattern, an experimental and clinical review of esophageal dynamics, and the protean manifestations of duodenal elastic tissue throughout the life of man, to mention only a few.

One of the most comprehensive articles is that in which Prof. Pettinari describes his observations of the liver and pancreas in the presence of hepatobiliary surgical diseases. Hepatomegaly with fibrodenia, hepatitis, generalized liver enlargement with hypertrophy of the Kuppfer cells was observed in 50 per cent of cases with calculous and noncalculous cholecystitis and choledocholithiasis concomitant disease of the liver and spleen, in which he observed pancreatitis and peripancreatic lymphadenitis.

Gastrointestinal surgeons will find it extremely interesting to read Battaglioli's account of eosinophilic infiltration in cases of gastritis and gastric ulcer.

Orthopedics, genitourinary surgery and neurosurgery are poorly represented. This deficit, however, is more than balanced by the excellent original articles on thoracic surgery. One worthy of mention deals with a rare tumor between the esophagus and the lower end of the trachea which was not anatomically related to its parent parenchyma.

This publication is most valuable to students, general surgeons and those interested in surgical research. Unfortunately the material is not properly indexed.

S. L. GOVERNALE, M.D.

**Acta Orthopaedica Scandinavica, Copenhagen:** Ejnar Munksgaard, 1953. Pp. 85.

This pamphlet reviews a variety of material previously published in one of the Scandinavian languages. Each article was originally read before the 26th Assembly in Oslo, June, 1952, or has been published by one of the leading institutions since that time.

It contains an interesting article on investigations of the balance of calcium, phosphorus and nitrogen in connection with surgical operations on the skeleton, by Drs. Hirsch and Luft.

A paper by Dr. Stahl on post-traumatic absorption of the outer end of the clavicle is presented. There is also a paper by Dr. Severin on anterior and posterior recurrent dislocation of the shoulder, among other interesting orthopedic subjects.

The articles are well illustrated. The translation is well done, and the presentations make excellent reading.

**Carcinoma of the Colon.** By Leland S. McKittrick, M.D., and Frank C. Wheelock, Jr., M.D. Publication 189 of the American Lecture Series. Springfield, Ill.: Charles C Thomas, Publisher, 1954. Pp. 94, with 12 illustrations.

This is a monograph of American Lectures on abdominal viscera. Compact as it is, the little book has all the pithy, solid material one would ask from any large collection of papers or group of volumes. The book is divided into eleven chapters. The topics include etiology, prevention, diagnosis, pathology, anatomy, treatment, operative procedures, postoperative care, polyps, surgical technic and the results of resection.

The chapter on diagnosis, treatment, operative procedures and polyps are in outline, with particular attention paid to preparation of the bowel with and without obstruction.

Principles of resection of the colon with anastomosis are placed in outline with important fundamentals such as type of exposure, mobilization of bowel with and without colostomy.

This is an excellent monograph on carcinoma of colon. There should be monographs of this type on carcinoma of all the like organs. Surgeons, proctologists especially, and all medical men in particular, would be fascinated by such a "large" small book.

**Diseases of the Knee: Management in Medicine and Surgery.** By Anthony F. De Palma, Philadelphia: J. B. Lippincott Company, 1954. Pp. 840, with 455 illustrations.

The contents of this excellent book are divided into fourteen chapters. The author starts with the evolution of the knee joint, proceeds to the comparative anatomy of the same. He devotes his third chapter to normal anatomy and his fourth to the mechanics of the knee joint.

The next few chapters cover in detail abnormalities of the menisci, disorders of the extensor apparatus of the knee joint, congenital and acquired deformities of the knee joint, traumatic lesions of the ligaments, fractures and wounds about the knee joint, loose bodies, abnormalities of the synovialis and the bursae of the knee joint, and arthritides, after which a complete chapter describes surgical approaches and procedures. The last chapter is on bone neoplasms in the region of the knee joint.

The illustrations are of exceptionally good quality. The printing and paper are excellent, and the book is highly recommended for the library of every hospital.

**Surgical Pathology.** By Lauren V. Ackerman. St. Louis: The C. V. Mosby Company, 1953. Pp. 836, with 913 illustrations.

Ackerman's *Surgical Pathology* shows an interesting new approach to the field. The author, with his broad experience, introduces the beginner not only into the technic of surgical-pathologic diagnosis; he also demonstrates the pitfalls an inexperienced pathologist would encounter in a quick diagnosis of certain conditions. It is natural that a book written by so forceful a personality as Ackerman will contain some statements with which other pathologists may disagree.

A striking feature of this book is the large number of excellent photographs of gross specimens and microscopic sections, which are invaluable to the student of surgical pathology.

All the fields of surgical pathology are well discussed, and the clinicopathologic correlation that follows most chapters adds an additional value to the book.

This book is a "must" for the young surgeon and the resident in pathology and is a valuable addition to every pathologist's library.

WERNER F. EISENSTALDT, M.D.

# Abstracts from Current Literature

**Benign Tumors of the Lung.** Thomas, C. P., Lancet 1:1, 1954.

The incidence of bronchial adenomas, hamartomas, vascular tumors and endobronchial fibromas as a group compared with that of bronchogenic carcinoma is admittedly very small; "yet in a large majority of these cases, if the condition is not recognized, the complicating element of infection induces a high morbidity, leading not only to a life of prolonged invalidism but also to permanent and irreparable damage to the area of lung situated beyond the site of the tumor.

"The incidence of malignancy is so low that it is possible for practical policy to ignore it.

"If these tumors can be recognized early in their evolution, local removal is possible, without the sacrifice of any normal lung tissue, by resecting the endobronchial tumors with the portion of the bronchial wall from which they are growing, and by enucleating those tumors which occur interstitially and by sewing up the defect.

"It is only by prompt recognition and investigation of the early symptoms that such a policy can be carried out, and the earliest findings of significance will be radiological evidence of a circumscribed shadow, when the lesion is interstitial; the presence of an area of emphysema with or without the normal changes in translucency occurring with inspiration and expiration; and often evidence of overinflation or of deflation of the area of lung involved. Recognition of these early findings with the aid of bronchoscopy alone will lead to prompt diagnosis and make possible the application of such conservative treatment as will be best for both patient and surgeon."

HENRY J. ROSEVEAR, M.D.

**"Wire Phlebitis" (Phlebite Fil de Fer): A Note of Venous Pathology.** Favre, M.: Presse Med. 61:579, 1953.

Attention is directed to a venous inflammatory change, observed mainly in the legs, wherein a peculiar stripped, glossy or nodular cord is seen without involvement or adhesion to the overlying skin. The phlebitis is nontender and causes little functional disturbance, for which reason it may be discovered only accidently.

Histologically the picture differs from that usually observed in cases of phlebitis. There is a thickening of the inner layer of the venous walls, and leiomyomatosis is present. Dense sclerosis involves the whole vein.

There is only a mild infection, which is characterized by minor thrombosis and clusters of inflammatory cells in the blood clots, especially about the venous valves. The condition resembles the superficial or filiform type and must be differentiated from the latter.

S. A. Z.

**Prevention By Testosterone of the Adrenal Atrophy Produced by Cortisone Treatment.** Turiaf, J.; Zizine, L., and Jean, Y., Presse Med. 61:825, 1953.

Cortisone administered to the rat produces atrophy of the adrenal cortex which is histologically identical to that following hypophysectomy. Testosterone, if administered simultaneously with cortisone, prevents the adrenocortical atrophy in the rat without, however, reducing the cholesterol reserve in the adrenals and without removing the "thymo-atrophiant" action and the anti-inflammatory properties of cortisone.

Cortico-atrophy from cortisone occurs in human therapy. A prompt breaking down of Thorn's test with ACTH and an anatomohistological thinning of the adrenals take place.

Fluctuations in the adrenal functions were assessed in patients using the Thorn's test (four-hour test by intramuscular injection of 25 mg. of ACTH). The following observations were made: 1. Testosterone controlled the "cortico-atrophiant" potency in half of the tested cases. 2. The protective effect of testosterone, in doses of 25 mg. per week, caused no genital disturbance and no evidence of hyperandrogeny. 3. Histologic data on patients who died at the end of long courses of cortisone treatment were comparable with data from animal experimentation. The protective effect of testosterone on the adrenal cortices of animals or patients treated with cortisone is not effected by the interposition of the pituitary gland, but probably by direct action on the adrenal gland according to a process not yet defined.

4. Testosterone given with cortisone appears safe whenever the corticotherapy cannot be discontinued for a sufficient period to permit spontaneous repair of the adrenal.

S. A. Z.

**Therapy Not to Employ in the Treatment of Peptic Ulcer.** Pollard, H. M. Wisconsin M. J. 52:825, 1953.

Certain forms of medical therapy have been found not to benefit gastric and duodenal ulcer. Among these is dorsal splanchnicectomy for hypertension, which proved to be dangerous. In a series of 1,498 patients who underwent splanchnicectomy for hypertension during an eleven-year period, there were 13 cases of peptic ulcer. Two of these patients subsequently died of massive hemorrhage. A postmortem examination in each case revealed the presence of a large active duodenal ulcer. In neither case had there been any symptoms suggesting ulcer before the hemorrhage. Three other patients required laparotomy, 2 for hemorrhage and 1 for perforation. In each case the discomfort was mild and atypical. It seems clear that splanchnicectomy, performed on a patient who also has a duodenal ulcer, either abolishes or greatly reduces the normal epigastric pain sensations, so that the ulcer is permitted to advance to dangerous proportions without giving the usual warning signs.

The use of antisecretory and anticholinergic drugs to an excessive degree occasionally meets with difficulty, especially in patients with prostatic obstruction, as these drugs continue to have side effects capable of increasing atony of the bladder. If a patient has a pyloric obstruction, the use of these drugs may increase it. During the time of their use an increased tolerance to the drug may also develop and make their constant administration ineffective. Instances have also been observed of recurrence of the ulcer during use of these drugs, as well as increase in the size of the ulcer and the onset of hemorrhage.

The use of ACTH and cortisone for ulcer patients also causes difficulty. With ACTH there is an immediate increase of uropepsin. There is also a parallel rise of pepsin in the gastric juice. ACTH and cortisone interfere with wound healing, which is undesirable in the presence of an active peptic ulcer. The concentration of acid in the gastric juice may increase within one to two weeks by as much as 200 to 300 per cent. These facts may explain why one not infrequently encounters a flare-up of an old ulcer, the onset of hemorrhage from the stomach, or even perforation.

The author has had uniformly discouraging results in treating patients with gastric or duodenal ulcers when hormones such as enterogastrone or urogastrone have been employed for treatment.

HENRY J. ROSEVEAR, M.D.

**Office Culdoscopy.** Budge, B. C., M.D., Northwestern Med. 53:132, 1954.

Culdoscopic examination is a gynecologic procedure of considerable diagnostic value, allowing direct visualization of the female pelvic interior.

Indications for culdoscopic investigation include all circumstances under which it would be helpful to see the intrapelvic organs. The procedure is contraindicated whenever it is unnecessary, impossible or dangerous. It is unnecessary when the diagnosis is obvious; impossible in the presence of an intact hymen, senile atresia or a fixed, totally obliterative cul de sac mass, and dangerous in the presence of hemophilia, purulent vaginitis, cul de sac abscess, cardiac decompensation and shock.

Culdoscopy can bring to gynecology the approximation of diagnostic accuracy which the cystoscope has brought to urology.

EDMUND LISSACK, M.D.

**Aortography and Pneumography.** Kearns, W. M., Wisconsin M. J. 53:139, 1954.

Translumbar abdominal aortographic and presacral pneumographic methods are used separately or in combination. They complement each other and in turn complement previous urographic and other tests.

The diagnostic value of aortographic study lies in the fact that it reveals significant changes in the arterial pattern. An aortogram can be particularly helpful, for example, in differentiating a tumor and a cyst. If a cyst is present, the aortogram shows a lack of vascularity in the region; if a tumor is present, the aortogram shows increased density and usually an enlarged nutrient artery to the area.

In pregnancy the placenta may be accurately located, and knowing its location has been helpful in the identification of placenta praevia.

EDMUND LISSACK, M.D.

**Sympathectomy by the Axillary Approach.** Atkins, H. J. B., Lancet 1:538, 1954.

The author reports a method of exposing the upper part of the sympathetic chain through the axilla. Its chief advantages are the simplicity with which the second and third thoracic ganglion can be removed via the axilla, as well as removal of the fourth and fifth ganglion. The upper part of the thoracic sympathetic chain can be seen clearly in the upper part of its extent and the precise location of the ganglion determined. In this respect it compares favorably with the posterior approach and is much more accurate than the anterior approach.

Bleeding is controlled better through the axillary approach than when the posterior approach is used. In the axillary approach, the only tissues that are cut are the skin, fat, intercostal muscles and pleura. This is a degree of tissue disturbance equivalent to that produced by the anterior approach. The posterior approach, however, is far more traumatic, because it involves resection of rib and the mutilation of bulky muscles to a considerable depth.

The incision in the axilla heals well and is unnoticeable. In this respect it has distinct advantages over the anterior and posterior approaches.

Its main disadvantages are that the operation cannot be performed on both sides at the same session. It is impossible to investigate the possibility of a costoclavicular syndrome from this approach as can be done from the anterior approach. A history of pulmonary tuberculosis contraindicates the axillary approach.

The operation is done with the patient in a lateral position, with the uppermost arm extended 120 degrees. The incision is then made obliquely across the axilla in the line of the second intercostal space. In the posterior part of the wound lies the long thoracic nerve, the only structure of importance to be avoided. The incision is then deepened through the second intercostal space, opening the pleural cavity. The rib are retracted with a suitable retractor and the lung allowed to collapse. The thoracic sympathetic chain can be readily visualized shining through the parietal pleura. The ganglion then can be removed or a preganglionic sympathectomy performed as desired by the surgeon.

Complications have been occasional in small apical pneumothorax, pleural fusion, hemorrhage and surgical emphysema of the tissues of the axilla and neck. Postoperative pain has been no major complication in the author's series of cases.

HENRY J. ROSEVEAR, M.D.

**Thermal Burns from the Atomic Bomb.** Pearse, H. E., and Kingsley, H. D., Surg., Gynec. & Obst. 98:385, 1954.

Tests were conducted on anesthetized pigs and dogs subjected to thermal burns produced by the detonation of atomic bombs. These animals were exposed behind clear quartz, timing shutters, filters and fabrics in stations located at fourteen different distances, covering the range from 1.1 to 43 calories per square centimeter. The results ranged from no burn to a char.

This was the first opportunity to obtain biopsy material from recent primary burns from atomic bombs. The lesions closely resembled those caused by laboratory radiant energy. In these experiments, no burns were produced in any animal through a filter transmitting only ultraviolet light. Burns of about equal severity were produced behind filters transmitting visible and infra-red rays. Dark-colored animals showed deeper burns than did white ones.

No burns were produced by the initial flash during the first twenty to twenty-five milliseconds. Burns created by the second maximum or fire ball were equal in severity to those caused by exposure to the total thermal pulse. Burns were caused in the first one-third second after detonation of the bomb. The cutaneous burns produced in the period between one-tenth and two-tenths second after detonation were the most severe of any by a one-tenth second interval of the thermal pulse. The major severity of thermal burns was attained within the first three-tenths second and the maximum severity within the first five-tenths second after bomb zero. No burns were produced after six-tenths second if the skin was shielded prior to that time. These results indicate that evasive action is of little value.

There is a good relation between the measured thermal energy and that determined by evaluating the skin burns from laboratory standards during the first two-tenths second. After this, the measured values were always significantly higher.

Future experiments will be needed to determine the value of clothing for protection.

HENRY J. ROSEVEAR, M.D.

**Some Difficulties in Evaluating Functional Results After Mitral Commissurotomy.** Soloff, L. A., and Zatuchni, J., J.A.M.A. 154:673, 1954.

This timely critical evaluation of the reported benefits of mitral commissurotomy opens with the challenging statement that the postoperative functional improvements must, for the present, be taken on faith.

The chronicity of the causative rheumatic fever, characterized by unpredictable remissions and exacerbations, indicates the urgent need for studies extending over many years before and after surgical intervention. In this manner only is it possible to assess accurately the value of this essentially blind and crude surgical attack on a single lesion of this complex disease.

Psychogenic dyspnea in response to a glamorous cardiac operation may be interpreted as a beneficial effect of the procedure.

A significant number of patients have been reported in whom exploration has found the disease unsuited for surgical treatment. Yet many of these sham operations have been followed by remarkable functional improvement.

Very important also is the frequent morbidity, which is usually due to reactivation of rheumatic fever and occasionally to the surgical production of mitral regurgitation. In addition, mitral commissurotomy has a higher immediate mortality rate (at least 6 per cent) for any group than the naturally occurring rate (about 1 per cent).

These, and additional potent arguments, emphasize the importance of studying the place of surgical treatment for mitral stenosis by the most exact and realistic methods attainable.

THOMAS WILENSKY, M.D.

**Surgical Aspects of Choledocholithiasis.** Waugh, J. M., Johnston, E. V., and Cain, J. C., J.A.M.A. 154:734, 1954.

This report is a detailed statistical study of 175 consecutive cases in which stones were removed from the common duct by the senior author.

Forty-seven patients (27 per cent had undergone previous surgical procedures on the biliary tract or surgical exploration for complaints that were eventually localized to the biliary tract.

In connection with the problem under consideration it is important to observe that the incidence of choledocholithiasis in patients undergoing cholecystectomy at the Mayo Clinic has ranged from 10 to 16 per cent.

Stones in the common duct produce physiologic changes and clinical symptoms that may vary widely. The usual indications for exploration of the common duct are quite well-known and conceded but, says Waugh, "in order to decrease further the mortality associated with this disease we must prepare to explore every common duct about which any suspicion of choledocholithiasis exists." The relation of pancreatitis to choledocholithiasis and cholangitis has been frequently observed. Exploration of the common duct is thought to be indicated for patients with cholelithiasis in whom pancreatitis is noted at exploration, not only to rule out and correct any obstruction at the ampulla but to establish drainage of the common duct if the inflammatory process is marked.

Needle aspiration of the common duct may recover cloudy or turbid bile, indicating cholangitis, which is occasionally present in the absence of obstruction and dilation of the duct.

The operative mortality rate in 175 "positive" explorations of the common duct was 3.4 per cent. Five of the six deaths occurred before 1945. As has been noted in other reports the mortality rate was higher in men than in women.

THOMAS WILENSKY, M.D.

**Results of Mitral Valvotomy.** Müller, O., Acta Chir. Scandinav. 106:277, 1953.

The author reports 23 cases of rheumatic mitral stenosis treated with mitral valvotomy. The operation was not performed on any patient over 50 or under 30 years of age. Of the 23, 4 had mitral and aortic disease, 6 mitral stenosis and incompetence and 13 "pure" mitral stenosis. The results are assessed in relation to pulmonary resistance and complicating lesions. There was 1 death due to cerebral embolism. Improvement was good in 13 of the 20 cases followed up, and excellent in 5 of these 13. In no case, however, was the effort tolerance after operation within normal limits. The 3 patients with combined mitral and aortic lesions improved very little. There appears to be a fair correlation between the fall in pressure gradient between the left auricle and the left ventricle and the subsequent degree of reduction in invalidism.

S. A. GUENKDJIAN, M.D.